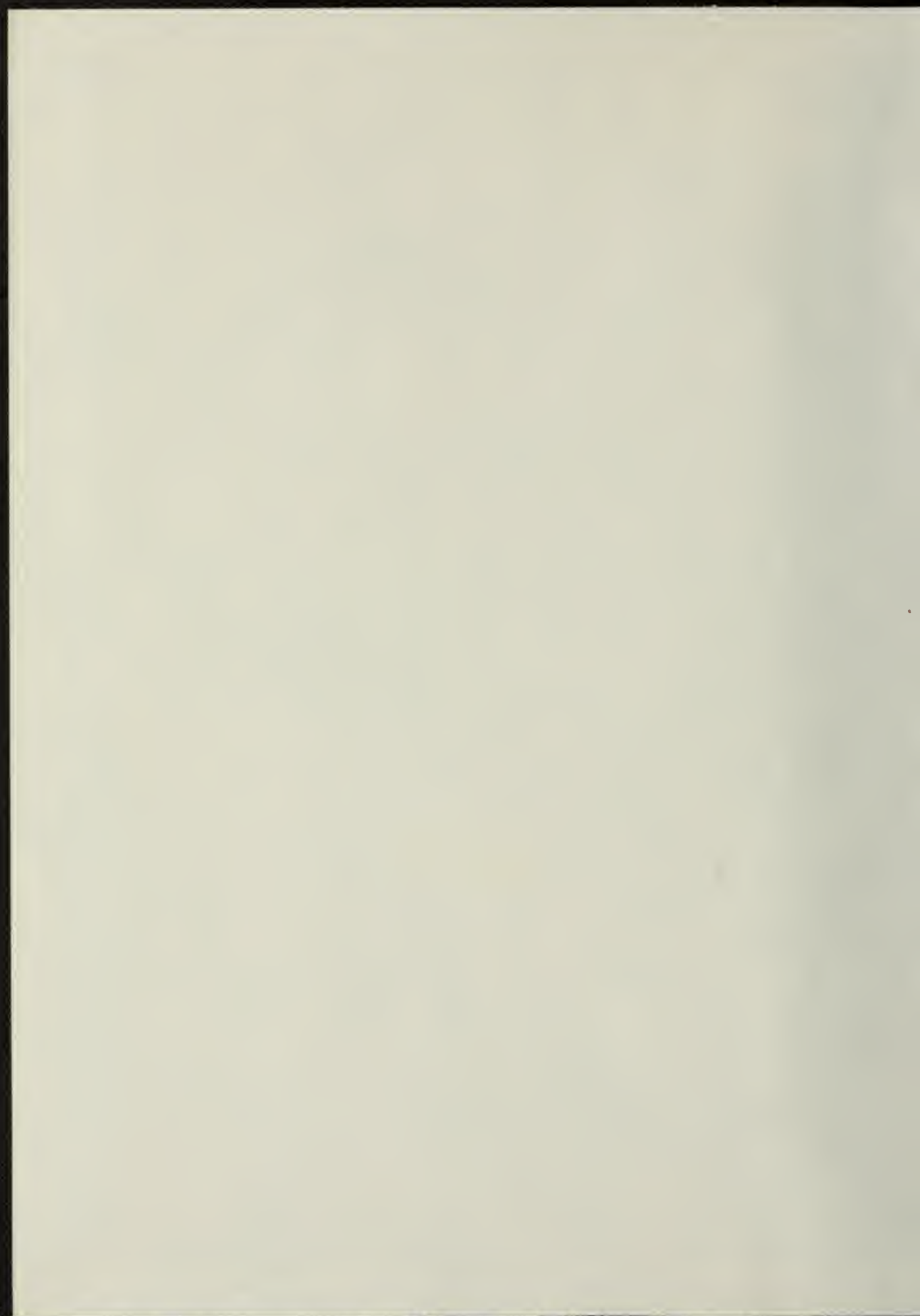




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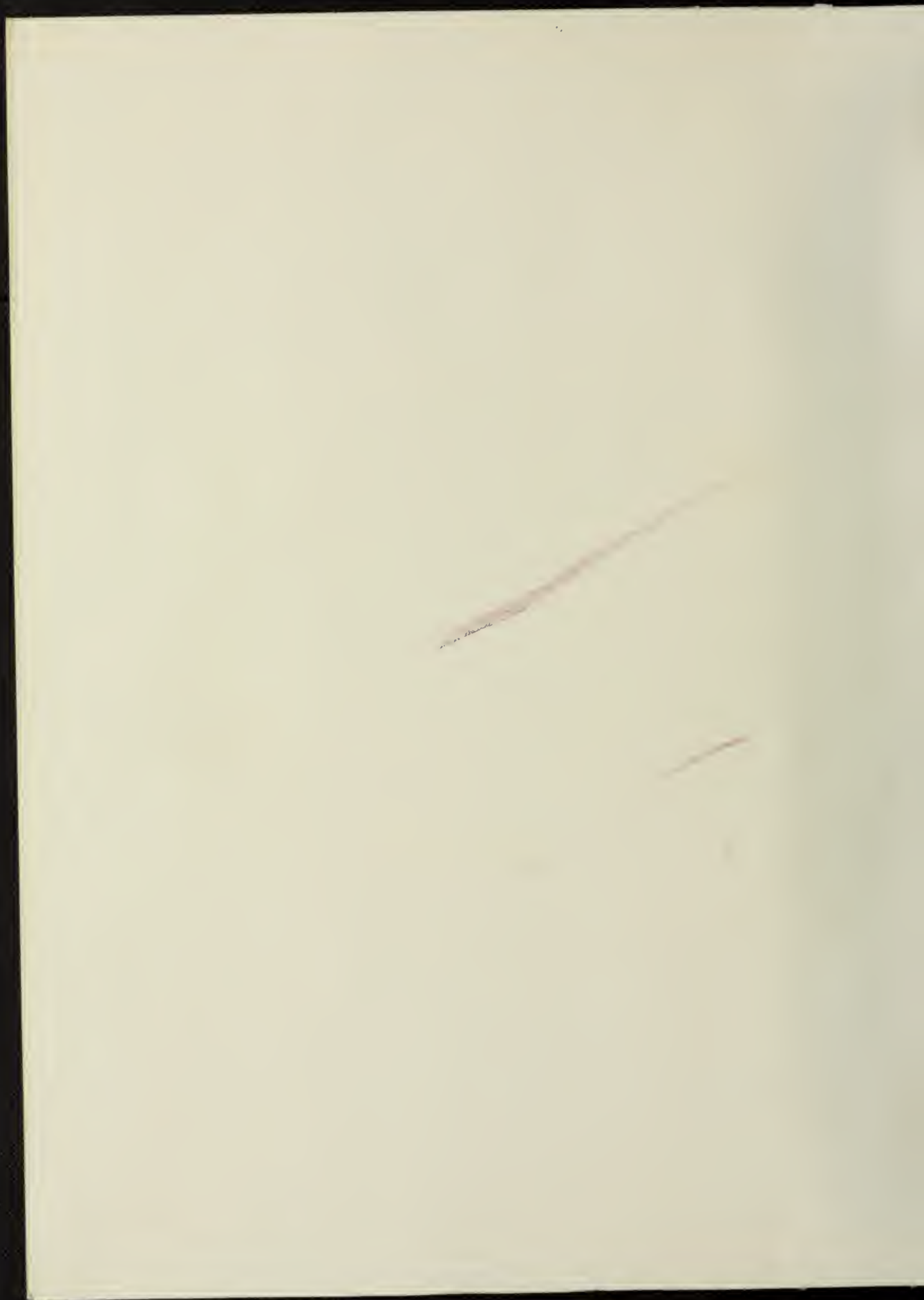












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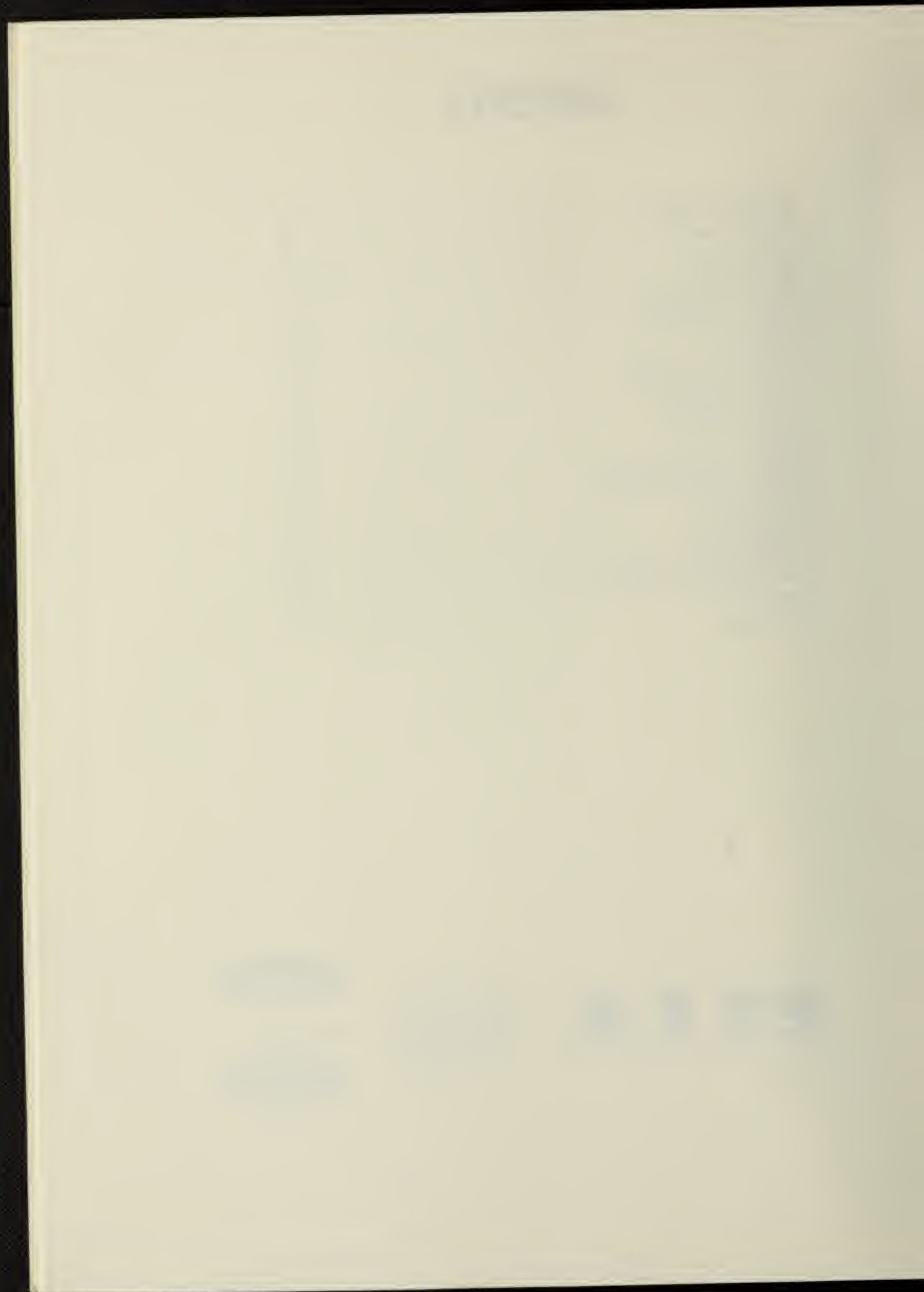


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## INTRODUCTION

*Application of Modern Technologies to International Development* (AMTID) is published as part of a program being carried out by the U.S. Agency for International Development (US AID) and the National Technical Information Service (NTIS). Its primary objective is to bring certain U.S. technical publications to the attention of interested individuals and organizations in developing countries to foster the transfer of technologies to these countries.

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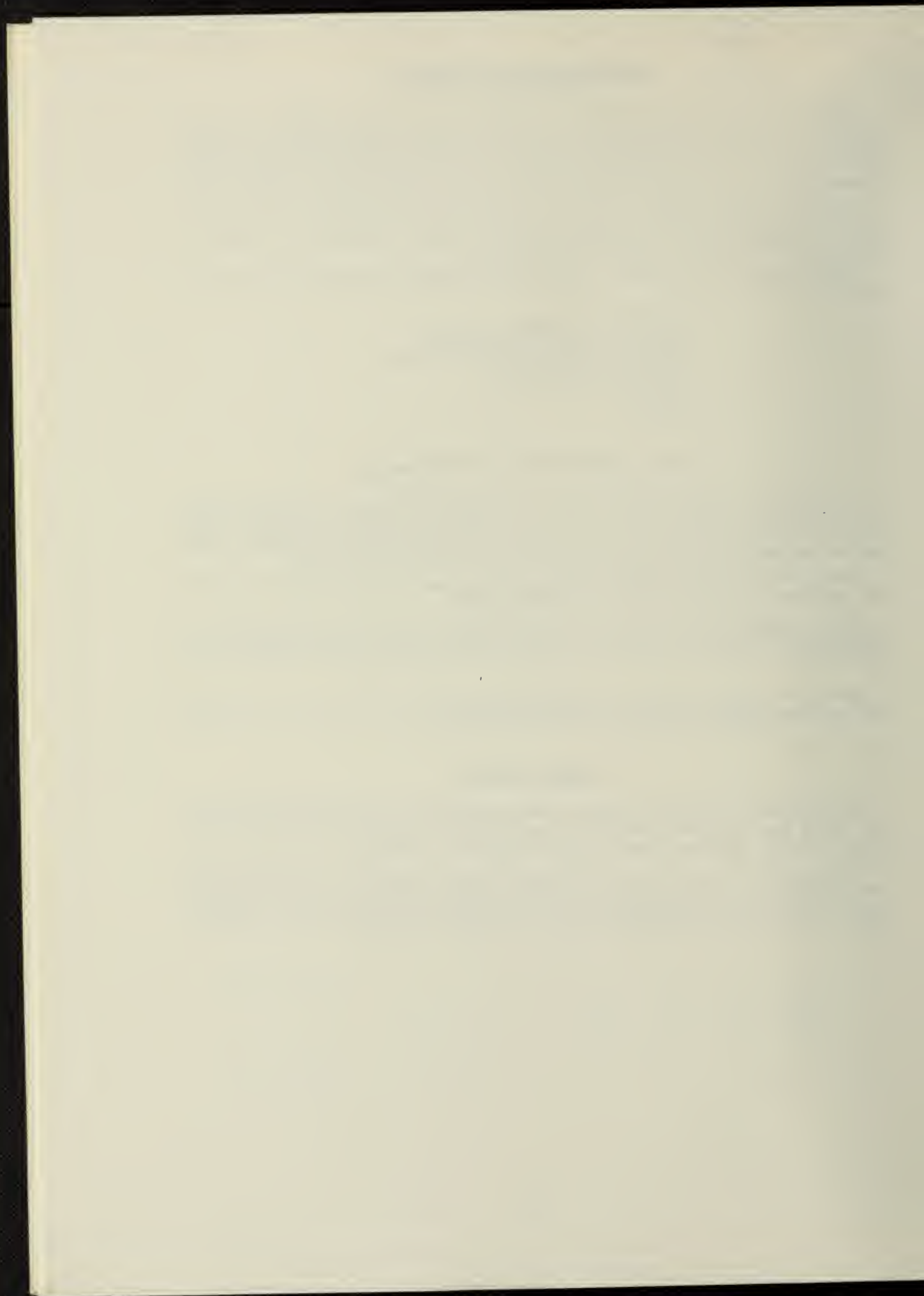
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# **AGRICULTURAL ECONOMICS**

## **AGRICULTURAL PRICES IN ECONOMIC DEVELOPMENT—THEIR ROLE, FUNCTION AND OPERATION**

Cornell University, Department of Agricultural Economics. John W. Mellor. June 1970. 37 pages.

**PB-216 299**

An effort is made in this report to provide understanding of the role, function, and operation of agricultural prices in the context of economic development, to improve the basis for determining public agricultural price policy. The material is based on studies undertaken in Chile, India, Mexico, Nepal, Pakistan, Taiwan, and Thailand. Consideration is given to: the effect of agricultural prices on transfers of resources among sectors of the economy, and the consequent impact of rates of growth in the nonagricultural sector and on overall growth processes; the effect of agricultural prices on growth of the agricultural sector, with emphasis on the demand for fertilizer and irrigation and on the diffusion of new technology; the efficiency of price-making mechanisms; problems of price stabilization; and the development of agricultural price policy.

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## **THE EFFECT OF AGRICULTURAL PRICE POLICIES ON INTERSECTORAL INCOME TRANSFERS**

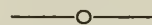
Cornell University, Department of Agricultural Economics. Roberto P. Echeverria. June 1970. 81 pages.

**PB-216 306**

The literature reflects very little empirical measurement of the effects of various agricultural price policies on the transfer of resources among sectors. In addition, there has been essentially no recognition of the effects of price induced income transfers on the relative incomes of various socioeconomic groups. This report approaches this problem by examining the allocative and distributive effects of relative price changes, and by examining the distributive effects relative to consumer welfare as well as to rates of capital formation. A set of socioeconomic groups is defined that are a product of the historical environment of Chile, although it is emphasized that such a definition must be specific to each situation. A methodology is then developed for measuring intersectoral flows induced by relative price changes and the use of this methodology



is illustrated with a carefully constructed set of data for the economy of Chile. This work provides the basis for related analysis in other countries and circumstances.

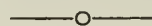


### **POSSIBILITIES FOR THE ECONOMIC REORGANIZATION OF MINIFUNDIA IN A HIGHLAND REGION OF COLOMBIA**

University of Wisconsin, Land Tenure Center. Emil Haney. November 1971. 145 pages.

#### **PB-219 333**

Like many less-developed countries, Colombia is experiencing an increased crowding of peasants onto the land despite flows of migrants from rural areas to cities and towns. Thousands of peasant families are being absorbed annually into the already densely settled rural areas of the country through continued land fragmentation, informal tenancy arrangements, land use intensification and, in some instances, declining levels of living. This document examines peasant farms and community structure in an intermontane valley east of Bogota, Colombia. It attempts to describe the mechanisms that link peasant families to other individuals and groups within the community and the larger society, and to document the consequences of these linkages. More specifically, it examines possibilities for increasing agricultural production and improving family levels of living in a community in which most of the population is dependent upon minifundia agriculture. Emphasis throughout is on how a better understanding of the process of change in a peasant community can suggest more effective policies for increasing the participation of the rural masses in the greater society.



### **LAND REFORM IN THREE COMMUNITIES OF COCHABAMBA, BOLIVIA**

University of Wisconsin, Land Tenure Center. Marcelo Peinade Sotomayor. August 1971. 102 pages.

#### **PB-219 338**

A case study is presented that examines the consequences and accomplishments of the Bolivian agrarian reform law in the Department of Cochabamba. The characteristics of the Bolivian agricultural sector are reviewed, and prereform land tenure in three case-study communities is discussed. The present living and working conditions of the campesinos in the area are closely examined. An analysis is made of the economic, social, and political changes after the reform period and of the extent of their connection with the implementation of the agrarian reform law of 1953. Differences in the changes between individual former haciendas, and between

former haciendas as a group and communities of farmers who owned their land before the reform, are compared.

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**POPULATION GROWTH, ECONOMIC PROGRESS,  
AND OPPORTUNITIES ON THE LAND:  
THE CASE OF COSTA RICA**

University of Wisconsin, Land Tenure Center. Carlos Joaquin Saenz. June 1972. 79 pages.

**PB-219 498**

Costa Rica is an almost unique case in the history of Latin America because of the land tenure patterns developed during the colonial period. These are responsible in no small measure for the social, political, and economic organization of the country today. This study of the economic development of Costa Rica analyzes the historical behavior of several economic variables and their interdependence as these affect the progress of economic growth. In addition, economic evolution is analyzed within the broader context of the nation-state, where the role of the economy is influenced by, and influences changes in, political and social structures. Specific topics considered include: Colonial land tenure and the introduction of coffee; development with limited supplies of labor during the period 1821-1920; expansion of the subsistence economy after 1920; the role of the agricultural sector in providing employment opportunities; and the nature of subsistence agriculture in Costa Rica.

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**THE MEASUREMENT OF BIASED TECHNICAL  
CHANGE IN THE MANY FACTORS CASE:  
US AND JAPANESE AGRICULTURE**

University of Minnesota, Department of Agricultural and Applied Economics. Hans P. Binswanger. December 1972. 44 pages.

**PB-219 701**

The induced innovation hypothesis in transfer of technology to developing countries is that labor income and employment can rise if the developing nation adapts advanced techniques to its own endowments. The report presents a way to measure factor saving biases of technical change, and applies the methodology to two developed economies—the US (1912-68) and Japan (1893-1962). The purpose of measuring biases in two countries is to test the induced innovation hypothesis at a very basic level; If biases of technical change are exogenously given, then the two countries should exhibit similar biases during the same time period; if internal economic variables such as factor prices, interest rates, and extent of the market influence the biases, the



biases are endogenous and will differ between the economies. Sophisticated statistical methods are used, and mathematical models are set up to show the proportionate values of land, labor, machinery, fertilizing, and similar factors in the agricultural economic development of the US and Japan. Conclusions regarding the endogenous nature of the biases are drawn.

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### **TRACTOR MECHANIZATION AND RURAL DEVELOPMENT IN PAKISTAN**

Harvard University, Development Research Group. Carl H. Gotsch. December 1972. 72 pages.

**PB-219 755**

The development and diffusion of technology occupy a place of critical importance in the development strategy of any economy. In the case of mechanical innovations, the benefits of borrowed technology are rather unclear. This document considers this problem with respect to tractor mechanization in Pakistan. The first section discusses the present status of mechanization, with consideration given to the number, use, and location of tractors in Pakistan; government policies toward mechanization; existing research on the economies of mechanization; and direct and indirect social costs and benefits. The variables of absolute farm size and distribution of holdings, the characteristics of the land tenure system, and the nature of the public and private organizations that provide services to rural people are examined in the context of the diffusion of mechanical power. Finally, the mechanization process is related to the general process of growth and change that occurred in Pakistan agriculture during the 1960's.

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### **CAPITAL FORMATION ON THE ECUADORIAN FRONTIER: A STUDY OF HUMAN INVESTMENT AND MODERNIZATION IN THE RIOBAMBENOS COOPERATIVE**

Cornell University Agricultural Experiment Station, Department of Agricultural Economics. Peter M. Gladhart. April 1972. 76 pages.

**PB-224 222**

This document concerns the formation of a modern sector of independent smallholders on the Ecuadorian frontier. It describes in detail the agricultural production activities of a small group of spontaneous settlers, the *Riobambenos del Rio Chilimpe*, focusing upon the determinants of family income and investment. Special attention is given to an historical analysis of the transformation of virgin rain forest into productive plantations and pastures. The analysis presents some tentative conclusions on the long-term rate

of family labor investment and the growth of agriculture capital in a case where the developing frontier is strongly linked to the national economy. Also, a brief review is provided of the land tenure institutions of Ecuador's traditional agricultural sector, and the role of land settlement in national development policy. Consideration is given to the role of spontaneous land settlement for Ecuador's socio-economic modernization and development.

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### **RELATIVE PROFITABILITY OF IMPROVED ON-FARM WATER MANAGEMENT PRACTICES AMONG TENURE CLASSES IN MILAGRO COUNTY, ECUADOR**

Utah State University, Department of Economics. Allen LeBaron, Morris Whitaker, Phillip Lloyd, and Boyd Wennergren. March 1973. 129 pages.

#### **PB-224 226**

The Milagro Project is one of the oldest and perhaps best established irrigation projects in Ecuador. It is located in Milagro County and currently provides dry-season water to over 7000 hectares of mixed crops in the Guayas Basin. Water users bear the cost of project construction and maintenance and, also, the cost of investment in their own on-farm irrigation systems. This document is concerned with an economic evaluation of the success of the Milagro Project. More specifically, it is concerned with the relative profitability of private investment in on-farm water distribution systems among various tenure classes. A brief description is given of the region served by the Milagro Project and of the major economic factors affecting it. Several conceptual models are developed, and these are applied to an empirical analysis of gross revenue, fixed production costs, variable production costs, net revenue, internal rate of return to technology, rates of return under simulated conditions. Policy implications of the results are discussed.

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### **INDIVIDUALIZED LAND TENURE AND AFRICAN AGRICULTURAL DEVELOPMENT: ALTERNATIVES FOR POLICY**

University of Wisconsin, Land Tenure Center. Richard L. Barrows. April 1973. 29 pages.

#### **PB-224 228**

The seeming inability of traditional African land tenure systems to adjust rapidly to the changing needs of economic development has prompted much discussion among development planners and policy-makers alike. This document discusses the influence of land tenure institutions on agriculture development. The frame of ref-



erence is that of an agricultural system based on shifting cultivation and a land tenure system based on extended family or lineage control of usufruct of land. The agricultural and tenure systems of the Mende and Lumba peoples of Sierra Leone are used as illustrations in the discussion. The basic argument is that land tenure rules define opportunity to earn income in agriculture and also define the security with which that opportunity is held. Customary tenure rules which emphasize security of opportunity have proved flexible in adjusting to the rapidly changing economic environment in modern Africa.

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### **LIVESTOCK PROJECTIONS BY THE TECHNIQUE OF FLOW CHARTS**

University of Minnesota, Department of Agricultural and Applied Economics. Abdelmagid Slama, Willis Anthony, and John De Boer. January 1972. 18 pages

#### **PB-224 229**

Effective agricultural planning requires realistic projections of the production and utilization of agricultural products. On the production side, the task for annual crops is fairly easy. The situation is more complex for large animals, however, due largely to the lengthy regeneration level. This document presents a method for projecting, period by period, the important variables of livestock production. Flow charts are used to show the linkage between flow variables (production, herd additions, losses) of one production period and those of subsequent periods. A breeding herd for a base period is defined, and it is projected from one period to the next according to the relevant parameters (breeding interval, birth rate, mortality rate, slaughtering rate, etc.) The process is general. It may be applied to a particular geographic region, or used in a planning exercise after defining and fixing the technical and biological parameters that fit the specific agricultural environment.

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### **FINANCING AGRARIAN REFORM THROUGH BENEFICIARY PAYMENTS: THE CHILEAN CASE**

Cornell University Agricultural Experiment Station, Department of Agricultural Economics. Richard L. Meyer. April 1972. 110 pages.

#### **PB-224 230**

Chile is one of the Latin American countries that seriously tried to respond to the Alliance for Progress goal of effecting agrarian reform so that land would provide economic stability, increased welfare, and a guarantee of freedom and dignity for the man who tills. The program, which had its beginnings in 1964 with the election of President Frei, sought to create 100,000 new property

owners over a six-year period. The ability of the beneficiaries of the program to pay became, for several reasons, crucial to its success. This document evaluates the capacity of a selected group of beneficiaries to pay assessed debts, considering both current and potential farm income. Since debt recuperation is only one goal of reform, farm level adjustments to increased debt repayment capacity are also analyzed for their impact on other reform objectives such as increasing gross output and farm employment. Finally, some policy alternatives are suggested which might assist the program to more fully achieve its overall goals.

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## **THE PUEBLA PROJECT: PROGRESS AND PROBLEMS**

Colorado State University, Department of Economics. Huntley H. Biggs. July 1972. 31 pages.

### **PB-224 295**

Development planners and politicians are paying increasing attention to the problems of subsistence farmers who populate the majority of the world's arable land. One of the few actual attempts to offer practical solutions to these problems has been under way in Mexico since 1967. This is the Puebla Project, which was initiated for the specific purpose of increasing maize yields on small farming operations. This document provides a description of the Puebla Project in its approach to the research and extension problem of small-scale subsistence farming. It also examines obstacles to continued progress in the project. In addition to material relating specifically to the Puebla Project, consideration is given to the general problem of the significance of subsistence farming in the process of development, and to the reasons for the relative lack of attention in the past accorded to this sector by development planners.

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## **DYNAMIC MODELS OF AGRICULTURAL DEVELOPMENT WITH DEMAND LINKAGES**

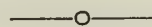
Cornell University, Department of Agricultural Economics. Mohinder S. Mudahar. March 1973. 71 pages.

### **PB-224 363**

Most of the empirical work describing agricultural development in the economically less developed countries is concerned mainly with analyzing the acreage response to price changes and estimating price elasticities of various agricultural commodities. However, there are many other crucial variables that are not incorporated or that are incorporated unsatisfactorily in agricultural development models. This document develops mathematical, dynamic, and positive models of farm decisions that simultaneously incorporate the great variety of interrelated microeconomic details of agri-



cultural and development and account for the salient features of traditional agriculture in transition. Specific attention is directed to the substitution between farm and nonfarm consumer goods and to exogenously versus endogenously determined product prices. The analytical properties of these models are explored by computer simulation. Also, simulation experiments were conducted to investigate their ability to represent farmers' behavior in a realistic manner and to project possible responses to different government programs, changed environmental conditions, and alternative model specification. The agricultural sector of the Indian Punjab is used by way of example.

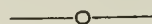


### **A MICROECONOMETRIC CHRONICLE OF THE GREEN REVOLUTION**

Ohio State University, Department of Agricultural Economics and Rural Sociology. Inderjit Singh, and Richard H. Day. March 1972. 35 pages.

#### **PB-224 364**

This document presents the detailed results of a recursive linear programming model used to simulate the agricultural history of the central districts of the Indian Punjab during the years 1952 through 1965. It focuses on productivity, capital utilization, employment, technological change, factor substitution, commercialization, and mechanization. Inferences suggested by the results concerning the nature of development and its future course are discussed. The specific case of the Punjab is then extrapolated to the general process of sector development as it might occur elsewhere. Consideration is also given to problems that might come to dominate agricultural development policy in the future.



### **LAND REFORM ADMINISTRATION PROCEDURES IN THE PHILIPPINES: A CRITICAL ANALYSIS**

University of Wisconsin, Land Tenure Center. Lilia C. Pangani-ban. 1971. 45 pages.

#### **PB-224 366**

This report provides an analysis of the land reform program in the Philippines as it existed in 1971. It seeks to understand the policies and objectives of Philippines land reform and assess how well these are being implemented through the centralized integrated administration stipulated by law. The first section reviews the social, economic, and political factors relevant to the administration of the land reform program. The objectives, policies, and programs of the Philippine land reform program are then described, with emphasis on provisions relating to the administrative



procedures for land reform. Finally, the actual implementation of the program is discussed, with emphasis on how policies and objectives are being implemented.

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## **AGRICULTURAL DEVELOPMENT IN CENTRAL AMERICA: ITS ORIGIN AND NATURE**

University of Wisconsin, Land Tenure Center. Rodolfo Quiros-Guardia. January 1973. 113 pages.

**PB-224 371**

The economic development of the Central American nations has been dominated by the growth of the agricultural export sector. This has led to a structural and institutional framework in agriculture characterized by a dual economic system—a traditional sector oriented to domestic market production and a modern sector geared to production specialized for export to world markets. This document seeks to define the origin and nature of the main development problems in Central American agriculture. The first section presents the historical foundations of the dual economy in the colonial and post-colonial periods (up until 1950). Next, the role and performance of contemporary Central American agricultural economies are evaluated in terms of external balance, internal growth, and employment and income distribution. Finally, the contemporary agricultural economy is analyzed in terms of structural and functional organization, and some implications for agricultural development policy are discussed.

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## **DISTRIBUTION OF FARM INCOMES UNDER ALTERNATIVE POLICY REGIMES: A DYNAMIC ANALYSIS OF RECENT DEVELOPMENTS IN SOUTHERN BRAZIL (1960-70)**

Ohio State University, Department of Agricultural Economics and Rural Sociology. Choong Yong Ahn, and Inderjit Singh. August 1972. 80 pages.

**PB-224 414**

This analysis seeks to provide insight into the impact of recent policies in Southern Brazil on the growth, distribution, and inequality of farm incomes for different farm sizes. This is done within the framework of a dynamic model that was explicitly constructed to stimulate regional development in Southern Brazil in the 1960's. In addition to simulating development under actual policy conditions that included a vast program of subsidy for wheat producers in the region, the model is used to simulate this development under alternative pricing and credit policies. The model used is described and the policy parameters that were simulated using this model.

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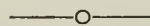
# AGRICULTURAL TECHNOLOGY

## SOILS OF THE HUMID TROPICS

National Academy of Sciences—National Research Council, Committee on Tropical Soils. 1972. 229 pages.

**PB-212 974**

If soil areas in the humid tropics that are most likely to respond to modern technology could be identified and if the most efficient uses of these soils were better understood, much more land could be successfully utilized. It has been estimated, in fact, that if 2% of the potentially arable but presently uncultivated land in the humid tropics were put into cultivation with good management, enough food could be produced to feed the entire population of Latin America. This document is the result of an effort to assess the present state of knowledge of soils of the humid tropics and to establish major research needs. Its contents cover the following topics: priority research needs; soil surveys; soil microvariability; physical properties of soils; soil nitrogen and organic matter; soil phosphorus and sulfur; soil potassium; soil acidity and liming; soil micronutrients; soil silicon and plant nutrition; fertilizers; soil management systems; soil testing and soil fertility evaluation services.



## HERBICIDE USE AND NOMENCLATURE INDEX

Oregon State University, International Plant Protection Center. H. H. Hepworth, and R. R. Fine. 1971. 186 pages.

**PB-215 996**

An enormous amount of technical information concerning herbicides is currently available, yet many technical workers in the field frequently encounter a need for specific information that is difficult or impossible to satisfy. Often the sole information available is the trade names of herbicidal compounds. Or, if a worker has a name and chemical formulation, he may not be aware of all the tested or approved uses of a certain material. This *Index* is intended to provide a comprehensive cross-referenced manual to fill this information void. It is probably the first attempt to combine data on both use and identification. The first section is a listing of most of the world's commercial herbicides by common, trade, and chemical names along with the manufacturers. The second section contains a listing of herbicides by the food or fiber crops with which they are intended for use. Information is provided on the rate of application (pounds active ingredient

per acre), principal weeds controlled, time of application (based on the growth stage of the crop and the weeds), and other pertinent factors.

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## **WEED PROBLEMS OF TURKEY**

Oregon State University, International Plant Protection Center. Ercan Guneyli. April 1970. 25 pages.

### **PB-216 769**

A summary is provided of the agriculturally important weeds of Turkey and the efforts being made to control them. After a brief review of Turkey's agricultural economy, a discussion is provided of the weeds associated with the major Turkish crops—wheat, cotton, sugarbeets, and rice. Consideration is also given to the weeds of pasturelands, forests, and water bodies. Pesticide registration and government policy on herbicides is discussed. A brief discussion is also provided of the herbicide industry in Turkey. Finally, a listing of the major weeds of Turkey, by scientific name and English common name, is given.

---

## **A GENERALIZED CROP-FERTILIZER PRODUCTION FUNCTION**

North Carolina State University, Department of Economics. James G. Ryan. July 1972. 211 pages.

### **PB-219 683**

A generalized crop-fertilizer production function is derived and discussed in this document. The function adequately describes the response relation between measured soil characteristics, applied nutrients, weather, and crop yield. The data upon which the function is based come from potato-fertilizer experiments conducted over a seven-year period in the Sierra region of Peru. However, the function is "generalized" in the sense that it can be utilized under a wide range of soil and environmental conditions. It can be employed to generate specific fertilizer recommendations to farmers based on soil analyses.

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## **ORGANIC PHOSPHORUS IN SOILS WITH SPECIAL INTEREST IN SOILS OF THE TROPICS**

Cornell University, Department of Agronomy. K. J. Roberts, and R. M. Weaver. January 1973. 34 pages.

### **PB-219 690**

Significant deficiencies of plant available phosphorus occur in many of the highly weathered Ultisols and Oxisols of the tropics. For adequate crop production, these deficiencies must be over-



come by addition of phosphate fertilizers or else implementation of soil management practices that bring about an increase in the rate at which the largely unavailable, total soil phosphorus becomes available for plant uptake. The existing knowledge and literature on the subject of organic phosphorus in highly weathered soils of the tropics is summarized in this document. The three major topics covered are: Identification and determination of specific forms of organic phosphorus; mineralization of organic phosphorus; and determination of organic phosphorus.

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## **NITROGEN FERTILIZATION IN THE HUMID TROPICS**

Cornell University, Department of Agronomy. Richard H. Fox. November 1972. 27 pages.

### **PB-219 695**

In the humid tropics, as in temperate areas, sustained high production of nonleguminous crops can be accomplished only by the addition of nitrogen to the soil. This document provides a brief review of what is known about the fertilization of tropical soils with nitrogen, and gives the results of field studies concerning the most efficient means of supplying nitrogen fertilizer to nonleguminous crops. The review considers the need for and use of nitrogen fertilizers; sources of fertilizer nitrogen; placement and time of application; nitrogen losses from the soil;  $\text{NO}_3^-$  retention; soil test methods; and fertility maintenance. The field experiments, that were conducted in Puerto Rico with maize and sorgham, yielded results indicating that it is much more effective to apply nitrogen fertilizer four to five weeks after planting (rather than before planting), and that sulfur-coated urea is less effective than uncoated urea when application is made before planting. Optimal application rates and maximum yield data were also determined.

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## **DEVELOPMENT OF AGRICULTURAL MECHANIZATION TECHNOLOGIES AT THE INTERNATIONAL RICE RESEARCH INSTITUTE**

International Rice Research Institute, Agricultural Engineering Department. Amir U. Khan, and Bart Duff. January 1973. 25 pages.

### **PB-219 702**

The International Rice Research Institute (IRRI) located at Los Banos, Laguna, Philippines, is engaged in the development and extension of an appropriate agricultural mechanization technology for the rice-producing countries of Asia. In an effort to encourage indigenous manufacture of agricultural equipment in Southeast Asia, research and development services are provided free of cost



to small machinery manufacturers who individually cannot support activities of this type. This document reviews the activities of IRRI in this field, with emphasis on the following: A strategy for agricultural mechanization in the rice-producing regions of Asia; product planning; machinery design and development; and technology transfer and diffusion mechanisms.

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### **IMPROVEMENT OF THE NUTRITIONAL QUALITY OF WHEAT THROUGH INCREASED PROTEIN CONTENT AND IMPROVED AMINO ACID BALANCE**

University of Nebraska, College of Agriculture. V. A. Johnson, and P. J. Mattern. December 1972. 142 pages.

#### **PB-219 707**

The results of a five-year program on the nutritional improvement of wheat through the modification of the quality and quantity of wheat protein are summarized in this document. Useful new analytical techniques were developed, and new genetic sources of high protein were identified and used in breeding. Useful variation in lysine was uncovered and is being combined with high protein. The effect of production environment on protein and lysine content was determined. Physiological, morphological, and anatomical factors associated with protein and lysine variation were identified. Seed with potential for much improved nutritional value was distributed to several countries.

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### **DEVELOPMENT OF A SIMPLE STORAGE UNIT AND STORAGE METHOD APPLICABLE FOR HUMID AREAS IN DEVELOPING COUNTRIES**

Kansas State University, Food and Feed Grain Institute. Do Sup Chung. June 1972. 24 pages.

#### **PB-219 721**

The grain losses associated with harvesting, handling, and storing of food grain in developing countries constitute a serious problem. It is estimated that more than 40% of all food grain harvested is lost before consumption in some parts of the world, particularly in warm and humid areas, as the result of lack of adequate facilities and improper methods of handling, drying, and storing. A report is made on a project to develop a simple and inexpensive grain storage unit and storage method which can be used effectively at farm and local levels in such countries to preserve the quality of grain. Efforts are described in obtaining a unit and method that will not require electricity and that can be maintained and operated by unskilled labor. It is proposed that an adsorbant be placed into the grain storage mass to create a drier condition

without detriment to the grain. Maize was used in the preliminary investigation, and a silica-gel adsorbant. Results are discussed, and cheaper drying agents are suggested.

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### **TAILORING OF FERTILIZERS FOR RICE**

Tennessee Valley Authority, National Fertilizer Development Center. O. P. Engelstad, J. G. Getsinger, and P. J. Stangel. December 1972. 57 pages.

#### **PB-219 734**

A summary is provided of the activities and results of a four year research program aimed at increasing the effectiveness of fertilizers for rice. Much of the effort concerned the improvement of the effectiveness of nitrogen applied to rice grown under conditions of intermittent flooding. More than 75% of the rice acreage in Southeast Asia involves this type of water management. Losses of nitrogen from the soil are known to be very serious under these conditions. Various sources of nitrogen were tested under typical water management situations. Extensive test results are presented on surfur-coated urea, both from an agronomic and an engineering standpoint. Experimental results with selected rock phosphates used for direct application are included. Also tested were various sources and carriers of zinc. Agronomic data were obtained from greenhouse experiments and from field studies in the US and seven developing countries.

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### **POTENTIAL FERTILIZERS FOR DEVELOPING COUNTRIES**

Tennessee Valley Authority, National Fertilizer Development Center. September 1972. 20 pages.

#### **PB-219 735**

This document summarizes recent tests for the production of fertilizer materials that may have application in developing countries. It was found that materials such as granulated urea-phosphate rock and urea-ammonium sulfate probably could be produced in developing countries, although process details have not been worked out for large-scale production. No significant problems were encountered in pilot-plant tests that would prevent further scale-up. The production of urea-single superphosphate-based granules without ammoniation is a difficult process to control, and additional pilot-plant tests are needed to overcome operational problems. Some equipment modifications might improve operation. Tests thus far are promising for development of a coating material that would improve the physical characteristics of urea used under tropical conditions.

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## **AMMONIA-UREA SOLUTION FOR AMMONIATION-GRANULATION IN BRAZIL**

**Agricultural  
Technology  
(continued)**

Tennessee Valley Authority, National Fertilizer Development Center. Frank P. Achorn, and Owen W. Livingston. June 1972. 35 pages.

### **PB-219 740**

Many countries are considering alternative methods for increasing the output of fertilizers and fertilizer intermediates. This report gives details of a granulation process based on the ammoniation of superphosphates with ammonia-urea solution in a rotary drum granulator. The process is in use in Brazil and may have application in other developing countries. Information is based on actual experience during startup and operation of a plant in Porto Alegre. The report is intended to serve as a guide in granulation for countries not having such conventional materials as anhydrous ammonia and acids. The process may serve for an intermediate period to allow production of homogenous, granular products until such time that other granulation materials become available. Equipment used in this process is readily adaptable to the use of anhydrous ammonia and acids as they become available.

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## **SOIL NITROGEN SUPPLY PROCESSES AND CROP REQUIREMENTS**

North Carolina State University. W. V. Bartholomew. October 1972. 87 pages.

### **PB-219 741**

Of the elements that are essential for plant growth that are obtained from the soil, nitrogen is most likely to limit plant growth. Factors affecting the release and availability of nitrogen in soils are somewhat different than for other essential elements since nitrogen is found in the organic fraction. This document presents some of the principles affecting nitrogen availability and use that provide for maximum efficiency of fertilizer nitrogen in production of cereal crops, which are staples in the diet of many developing countries. The topics covered include: Inefficient nitrogen use by crops; nitrogen supply and loss processes; crop use and crop need for nitrogen; characteristics and limitations of natural nitrogen supply processes; processes controlling crop use of nitrogen; forecasting soil and crop need for fertilizer nitrogen; the basis system for making nitrogen fertilizer recommendations; nitrogen fertilizer application methods and their impact on nitrogen use efficiency.

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## **TRICKLE IRRIGATION SALINITY PATTERNS AS INFLUENCED BY IRRIGATION LEVELS AND APPLICATION RATES**

Utah State University. Philip David Tscheschke. 1973. 130 pages.

**PB-219 745**

During the past several years the trickle irrigation method has gained considerable attention in irrigated agriculture. One advantage noted is that crops may be grown using relatively high saline water. Another is that trickle irrigation with saline water produces no contact with the plant leaves and thus causes no leaf burn to sensitive crops. A study is reported of salt accumulation patterns in soil in relation to different trickle irrigation treatments. Three treatments were alternate day irrigations, one 13% under the evapotranspiration rate (ET), another equal to the ET, and the third 20% greater than the ET. A fourth treatment consisted of daily irrigation equal to the ET but seven times slower than the alternate day treatment. The experiment consisted of using cherry tomatoes planted in eight lysimeters, one replication for each irrigation treatment use. Two-dimensional contour patterns were obtained for both the saturation extract conductivity and the water water potential between two lines of emitters. Differences between the treatments are noted, and recommendations are made.

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## **ORGANOPHOSPHATE PESTICIDES FOR USE AS GRAIN PROTECTANTS IN INDIA: DEGRADATION OF THEIR RESIDUES DURING MILLING AND COOKING CEREAL GRAINS**

Kansas State University, Department of Grain Science. Leonard M. Lockwood. 1973. 104 pages.

**PB-219 753**

A primary cause of loss during the storage of food grain in India in insect damage, which has been estimated to be 5% to 10% of the total grain production. An important means of minimizing grain losses during storage is the control of insect pests by the application of pesticides to the grain or to the storage premises. Some organophosphate insecticides, such as malathion, are often used for this purpose because of their low mammalian toxicity and ease of degradation. However, the Government of India's rules for the prevention of food adulteration specify that no insecticide shall be added to any food. This document presents the results of a study of the extent to which the organophosphorus insecticides malathion, gardona, sumithion are degraded during milling and cooking when they are used in concentrations that are effective in controlling insect populations. Emphasis throughout is on approximating conditions to which the grain would ordinarily be sub-



jected as it is commonly processed in India. The results indicate that the prevention of food adulteration rules could safely be amended to permit the use of the subject organophosphates as protectants to be directly admixed with grain in storage.

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## **A REVIEW OF SOILS RESEARCH IN TROPICAL LATIN AMERICA**

North Carolina State University, Soil Science Department. P. A. Sanchez (Ed.). July 1972. 272 pages.

### **PB-219 758**

This publication provides a review of the available literature on soils research in the American tropics. This area comprises all countries of Latin America and the Caribbean, excluding Argentina, Chile, and Uruguay. The intent is to establish a factual base for an analytical interpretation of current knowledge and future needs relevant to the characteristics and management of tropical soils for crop production. The major subject areas included are: Soil genesis, morphology, and classification; soil physical properties; soil management under shifting cultivation; soil nitrogen in the tropics; fertilization; soil acidity and liming; potassium; phosphorus; sulfur; micronutrients.

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## **OIL SEED PRODUCTION IN THE TROPICS AND SUBTROPICS**

Agency for International Development, Office of Agriculture. January 1972. 69 pages.

### **PB-224 227**

This document provides a survey of the importance of annual oil-seed crops in developing countries and, also, certain basic information as to the characteristics and utility of the more important types. The species considered include groundnuts, sesame, sunflower, cottonseed, soybeans, and castor beans. The discussion treats each of these seven individually, as well as providing comparisons between them. Consideration is given to the characteristics of the plants; ecological adaptation; cultural practices for higher levels of productivity; world production centers; and world trade in the oil seeds, their extracted oils, and the cake or meal derived from the extraction of the oil. The information given should be useful for the evaluation of each crop's suitability for the economic needs of individual countries.

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## MINERALOGY AND BEHAVIOR OF TROPICAL SOILS

University of Hawaii. G. Uehara, L. F. Swindale, and R. C. Jones. 1972. 17 pages.

### PB-224 294

Extrapolation of temperate climate experience in agriculture to the tropics has been met with varying success. Soil mineralogy is one of several parameters which can be used to define the kinds of data which can be transferred from one region to another. This document describes the behavior of a group of mineralogically unique soils. These are tropical soils for which there exists a minimum of transferable data. The discussions include a brief overview of the mineralogy of tropical soils, the chemistry of oxide minerals. The behavior of soils with variable charge colloids; organic matter; and surface coatings.

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## CHEMICAL CONTROL OF VAMPIRE BATS (COMBATE QUIMICO DE LOS MURCIELAGOS VAMPIROS)

U. S. Bureau of Sports Fisheries and Wildlife, Denver Wildlife Research Center. G. Clay Mitchell, and Richard J. Burns. May 1973. 84 pages. (Text in English and Spanish)

### PB-224 506

Vampire bats attack and feed on the blood of man and animals throughout most of Latin America. Great numbers of livestock live within the geographic range of the vampire bat, which extends from northern Mexico to central Argentina. Many of these domestic animals suffer nightly attacks from the bats, which result in blood loss and which have the potential of transmitting rabies and other infectious diseases. This document describes two methods for controlling vampire bat populations, both of which are inexpensive, safe, and harmless to other animals. Both methods employ diphenadione, an anticoagulant that is lethal to vampire bats. One method involves capturing the bats in nets placed near livestock corrals, smearing a diphenadione paste on the captured bats, and releasing the bats. The bats return to their roosts where, owing to the very crowded conditions there, the control compound may contaminate as many as 20 other members of the roost colony. The second control method involves injection of diphenadione into cattle. The compound is relatively nontoxic to the cattle, but bats feeding on the cattle receive a lethal dose.

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# **BUILDING TECHNOLOGY**

## **PRINCIPLES FOR PROTECTING WOOD BUILDINGS FROM DECAY**

U.S. Department of Agriculture, Forest Products Laboratory. R. C. Scheffer, and A. F. Verrall. 1973. 58 pages.

### **AD-767 566**

The worldwide use of wood as a construction material arises from the abundance of trees, the ease of woodworking, an ability to withstand weather, and in many cases resistance to fungi and insects. Two major factors are noted in protecting wooden buildings from decay: moisture and natural degradation. The report is concerned principally with moisture, summarizing the moisture situations and construction features most responsible for decay in buildings, and discussing means of modifying or eliminating them. Emphasis is placed on the use of dry wood, construction methods to keep wood dry, and methods of treating wood with a preservative in regions naturally wet and humid. Some of the topics covered are the kinds of biological damage; wetting from various sources; foundation protection; protection of walls, appendages, and woodwork; shower, cold storage, and air conditioned rooms; types of preservatives; and inspections and correction methods.

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## **ABNORMAL LOADING ON BUILDING AND PROGRESSIVE COLLAPSE**

National Bureau of Standards, Center for Building Technology, Norman F. Somes. May 1973. 77 pages.

### **COM-73-11113**

Since 1968 there has been growing international concern that many buildings, particularly multistory buildings, have been designed without consideration of abnormal loading conditions. Certain building collapses give evidence toward that conclusion. The report identifies abnormal loadings, classifies them, and presents an analysis of their characteristics and frequencies of occurrence. Included are violent change in air pressure as the result of a bombing or explosion; accidental impact of a highway vehicle, construction equipment, or an aircraft; faulty practice such as design error, construction error, or misuse or abuse by an occupant; and foundation failure. A review is made of the state of international knowledge of abnormal loading characteristics and the response of buildings and building elements to them. Statistical data are

given, and some mathematical analysis are presented. Criteria are discussed, and some possible introductions for collapse risk reduction are made.

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## **TOLERANCE OF BUILDINGS TO DIFFERENTIAL SETTLEMENTS**

Massachusetts Institute of Technology, Department of Civil Engineering. Rebecca Grant, John T. Christian, and Erik H. Vanmarcke. December 1972. 68 pages.

### **COM-73-11325**

The report summarizes the results of a literature review on the tolerance of buildings to differential foundation settling. It was desired to determine the parameters that may be used to correlate structural damage and differential settlement, along with variables that may affect this correlation, to note the availability of relevant data and the type of information that can be extrapolated from it, and to observe the gaps in the data that must be filled before guidelines for design can be reliably established. Records of settlement related performance are analyzed, and limits for allowable settlement are suggested where adequate data are available. The maximum net slope of the deflection curve,  $\Delta/l$ , has been used for the correlations in 98 case histories. Cracking of panels in frame buildings or wells is related to this quantity, as well as values for settlement of foundations on clay, fill, and sand.

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## **STRUCTURAL CAPACITY OF REINFORCED CONCRETE COLUMNS SUBJECTED TO FIRE INDUCED THERMAL GRADIENTS**

University of California (Berkeley), Structural Engineering Laboratory. H. Bizri. January 1973. 207 pages.

### **PB-219 101**

It is becoming very important to have a sound way of predicting the structural capacity of structures during a fire, and analytical methods must be resorted to if a sound structural design for fire is to be made. This document describes a mathematical model capable of analyzing the nonlinear behavior of reinforced frame structures under fire conditions. The temperature distributions are found by the use of a two-dimensional finite element solution to the transient heat flow equation, and a nonlinear step-by-step time-load incremental technique is used for the structural analysis. In both solutions the variations of the material properties with temperature are considered. The model predicts the response of structural elements to short duration heating, thus providing a powerful



tool for the designer in choosing the structural elements which may be exposed to high temperatures. The model is capable of analyzing reinforced concrete columns, beams, and frames.

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### **PROCEEDINGS—EIGHTH SYSTEMS BUILDING SEMINAR: PLANNING AND DESIGN OF TALL BUILDINGS WITH EMPHASIS ON FIRE AND LIFE SAFETY SYSTEMS**

University of Kentucky, College of Engineering. December 1972.  
62 pages.

#### **PB-219 288**

The report considers fire as a physical and chemical event with identifiable structures and processes, predictable and therefore controllable. It discusses fire protection systems from the standpoints of research, engineering, prevention measures, ignition study, control activities, critical feedback, and return to further research. The proceedings are presented of a seminar on the planning and design of tall buildings, using a systems approach with reference to fire protection. Some of the topics covered are modular construction, fire detectors, fire retardants, automatic sprinkler systems, postfire investigations, smoke propagation, electrical systems, water systems, and people movement. The problems of high rise buildings were especially noted. Other topics of interest are flame spread, the combustibility of structural materials, carbon monoxide effects, and firefighting equipment.

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### **AN EVALUATION OF COMPUTER AIDED REINFORCED CONCRETE BUILDING DESIGN**

Massachusetts Institute of Technology. Robert Dean Sowards, and Robert D. Logcher. June 1973. 220 pages.

#### **PB-220 970**

STRUDL, the Structural Design Language, is a large scale computer system that was developed to assist engineers in structural analysis and design and which operates as a subsystem of an integrated civil engineering system. It is an information processing, storage, and retrieval system. The report makes a cost evaluation for designing reinforced concrete buildings. The method is graphic. Two buildings were used as vehicles for comparison, being first designed manually, then with STRUDL; all costs were documented and then compared, with particular reference to floor systems, beams and girders, and columns. Mathematical data are presented, and some conclusions are drawn. Computer costs are also given.

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## **MANUAL OF LUMBER AND PLYWOOD SAVING TECHNIQUES FOR RESIDENTIAL LIGHT-FRAME CONSTRUCTION**

NAHB Research Foundation Incorporated. June 1971. 93 pages.

### **PB-221 026**

Techniques are being sought to construct safe, durable, light-frame buildings that improve utilization of lumber and plywood and reduce waste. However, as reduction in construction material is accomplished, increased care in workmanship and quality control becomes more essential. This manual is intended for use by those concerned with safety and cost effectiveness, and is limited to construction techniques and methods which do not require extensive engineering analysis or structural testing. Only limited attention is given to using substitute or alternate materials. Chapter discussions cover floors, including joist systems and the elimination of certain elements; exterior walls, including components, doors, windows, and eliminations; interior partitions and ceilings, with eliminations; roofs, and trim. A section is devoted to personnel and materials management.

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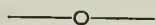
# CHEMISTRY

## **SPECTROCHEMICAL OIL ANALYSIS**

Mitre Corporation. D. F. O'Sullivan. January 1973. 43 pages.

### **PB-216 168**

"Spectrochemical Oil Analysis" is a term derived from the concept of using both spectrometric and chemical means to analyze used lubricants. Spectrometric oil analysis is a system of periodic maintenance applicable to oil-lubricated components in mechanical equipment. The system is based primarily on the assumption that the extent of wear at the surfaces of lubricated internal components is a function of their physical condition, and that it is reflected by the kind and content of metals in the used oil. Chemical analysis of lubricating oil is used to detect the presence of contaminants (fuel, water, carbon) which, in turn, is an indication of the remaining lubricating qualities of used oil. These methods have been successfully applied to periodic maintenance programs for aircraft and diesel locomotives, and to a much less extent to buses. This document provides a review of spectrochemical oil analysis with particular attention to its application to the maintenance of bus fleets. Emphasis is on experience gained by a number of bus operators, especially the Autoridad Metropolitana de Autobuses of San Juan, Puerto Rico. It is shown that spectrochemical oil analysis provides maintenance managers with a tool that can upgrade the diagnostic capabilities of their mechanics.



## **SPECIAL ANALYTICAL TECHNIQUES IN ENVIRONMENTAL MEDIA. THIN-LAYER CHROMATOGRAPHY**

U.S. Department of Health, Education, and Welfare, Environmental Control Administration. S. N. Dereniuk, J. D. Pfaff, E. Sawicki, and R. A. Simon. February 1970. 69 pages.

### **PB-216 371**

This document comprises a basic training and reference manual on thin-layer chromatography, with special reference to its application to problems associated with food protection, occupational health, water hygiene, and air pollution. The topics covered include: Fundamentals of thin-layer chromatography; fundamentals of paper chromatography; fundamentals of column chromatography; selection of the adsorbent and solvent; comparison of the various types of chromatography; spot detection and plate docu-

mentation; electrophoresis; two-dimensional chromatography; circular chromatography; modification of existing equipment; pre-coated plates; qualitative and quantitative chromatography; analysis of pesticides in the environment; chromatography of polynuclear hydrocarbons.

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### **MICA BENEFICIATION**

Bureau of Mines, Tuscaloosa Metallurgy Research Laboratory.  
James S. Browning. February 1973. 27 pages.

#### **PB-218 142**

Two methods for mica flotation have recently been developed and adopted by industry. One method uses acid cationic flotation for recovery of mica. This method requires thorough desliming of the ore with consequent fine mica losses. The second method uses an alkaline anionic-cationic process for recovering fine-size mica from pegmatite ores after desliming sufficiently to remove clay materials, but not so drastically as to remove fine mica. This report summarizes each of these methods. It also discusses details of commercial mica production, including methods of mining, recovering, and grinding mica, and information on the production, uses, and prices of mica.

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### **PRESENT AND FUTURE TECHNOLOGICAL AND COMMERCIAL STATUS OF ENZYMES**

Bernard Wolnak and Associates. December 1972. 234 pages.

#### **PB-219 636**

Enzyme processes have been employed since earliest times to bring about changes in foods, drinks, etc. Today enzymes play an important role in many industrial processes such as starch liquefaction, glucose production, cheese manufacture, baking, brewing, etc. Enzymes are also used as analytical tools in biochemistry and clinical chemistry. This document provides a detailed examination of the present and future markets and technology of enzymes. The properties, production, uses, and legal status are given for those enzymes that are now widely used in industrial processes. The main producers throughout the world are listed and projected markets are assessed. Although many thousands of enzymes are known to exist, only a handful are used and produced commercially. Therefore, a number of additional enzymes are examined that may have an interesting future in the coming decade. A great deal has been written about the immense potential of insoluble enzymes in industrial processes; and their present status and potential future are assessed. The smaller markets for highly purified research, medical, and diagnostic enzymes are discussed. Finally, opportunities that exist for enzymes and enzyme-containing products or processes in the coming decade are summarized.

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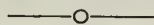


## **ANALYSIS OF UNDERGROUND OPENINGS IN ROCK BY FINITE ELEMENT METHODS**

Syracuse University, Department of Civil Engineering. Fred H. Kulhawy. April 1973. 287 pages.

**AD-764 123**

Even though methods of construction and techniques for predicting geologic conditions are rapidly improving, the recent literature contains numerous case histories of well-engineered underground openings in which substantial movement and breakage occurred. The fact is, sufficiently general theoretical methods for predicting the behavior of underground openings in rock are virtually nonexistent. Therefore, a study was initiated to investigate the practical application of the finite element method to predicting opening behavior, simply and realistically. The scope of the investigation included literature surveys to evaluate the nonlinear, stress dependent, and anisotropic properties of rock types and discontinuities; the establishment of modeling criteria for arbitrary excavation sequences, finite element meshes, rock behavior, and discontinuity behavior; an analyses of underground openings to evaluate the effects of opening shape, excavation sequence, initial stress values and orientations, material properties, and discontinuity orientation and properties; analyses of the relative importance of the parameters investigated; and a case history example. The excavation relationships are seen to simulate the nonlinear, stress-dependent behavior of rock quite well, with the jointed analysis method appearing to offer the most favorable results.



## **QUASI-CONTINUOUS EXPLOSIVE CONCEPTS FOR HARD ROCK EXCAVATION**

Whittaker Corporation. Nikolai A. Louie. June 1973. 45 pages.

**AD-765 792**

Extensive research is going on to find a substitute for present methods of drilling and blasting in excavating hard rock. One alternative being investigated for feasibility is the continuous-feed explosive system. Such technology, or a quasi-continuous one such as a closely spaced pulsed explosion system, could have major advantages, since continuous material handling, a high energy flux at the working face, and high localized control would contribute to a method vastly superior to current ones. A report is given on



pulsed explosions obtained by successively projecting small explosive charges in a closely spaced train against the rock face. Research objectives were to determine effectiveness in fracturing and removing hard rock, the mechanisms for operating such a process, and the utility of such a system for hard rock excavation. The experiments included single and multiple-charge firings. Results are discussed and recommendations are made for further work. The data were obtained for both granite and concrete.

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### **FUNCTIONAL CLASSIFICATION OF GOUGE MATERIALS FROM SEAMS AND FAULTS IN RELATION TO STABILITY PROBLEMS IN UNDERGROUND OPENINGS**

University of California, Department of Civil Engineering. Tor L. Brekke, and Terry R. Howard. July 1973. 209 pages.

#### **AD-766 046**

Tunneling through rock formations has always involved the problems introduced by faults and seams, but there is only a limited amount of information available on the behavior of the materials at discontinuity interfaces, the so-called gouge materials. These materials may result from faulting action, such as flattening, grinding, abrasion, granulation, pulverization, cementing, and chemical alteration; regional metamorphism, arising from the combined effects of temperature, pressure and shear stresses; the hydrothermal action of mineral bearing liquids at high temperature and pressure on a rock mass; and weathering, particularly chemical weathering after faulting has occurred. The report covers an investigation of underground stability problems, a thorough literature search, the study and sampling of gouge materials at construction sites, interviews with engineers and geologists, and laboratory tests that were performed. Observations are noted on standup time, squeezing behavior, swelling behavior, clay properties, and drilling and blasting characteristics. A functional classification system is proposed, and a discussion is made of appropriate construction methodology.

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### **FUNDAMENTAL STUDIES IN THE USE OF SONIC POWER FOR ROCK CUTTING**

Ohio State University. Karl F. Graff. April 1973. 200 pages.

#### **AD-766 047**

The major aim of present day research in innovative rock cutting technology is to discover an improved method of penetrating hard rock. The report discusses an investigation of two modes of rock cutting using high power, high frequency sonic transducers and an

impact coupling technique using a small bouncing cutting tool at the tip of the transducer. The first mode was simple drilling, the second layer cutting. The overall study was divided into a system development phase where laboratory cutting apparatus was tested, and a system analysis phase where basic studies of sonic processes and devices were carried out. Layer cutting was tested on limestone and then applied to granite. Although results to date are marginal, the method is of interest as part of a widespread program. The mathematical basis is presented and an explanation of the mechanical process is theorized.

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### **CELLULAR-BLOCK-LINED GRADE CONTROL STRUCTURE: HYDRAULIC MODEL INVESTIGATION**

U. S. Army Engineer Waterways Experiment Station. Bobby P. Fletcher, and John L. Grace, Jr. August 1973. 28 pages.

#### **AD-776 692**

There is a need for a method of providing for a sudden change in grade of the invert of a trapezoidal channel to establish vertical control in a drainage basin subject to gully scour. The reported investigation was initiated to develop a practical and inexpensive method to do this. Economic analysis indicates that a considerable cost saving can be realized if a cellular-block-lined structure can be used instead of the conventional reinforced concrete drop structure. A 1:4 scale physical model study was conducted to observe flow characteristics and develop the geometry required for a grade control structure lined with cellular blocks to accomplish a four foot change in grade within a trapezoidal channel conveying a discharge of 432 cfs.

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### **ROCK FRACTURE RESEARCH—SURFACTANTS**

Massachusetts Institute of Technology, Civil Engineering Department. F. J. McGarry, and F. Maovenzadeh. January 1973. 47 pages.

#### **PB-218 973**

As continuous investigation proceeds in hard rock excavation technology, innovative techniques are sought and tested. One of these is using surface active agents as weakening agents, to reduce the resistance of hard rocks to available cutters, to reduce the wear on cutters, and thus to improve the rate of advance in conventional tunneling through hard rock. The report covers controlled laboratory environmental tests and experiments in actual tunneling operations in the field. The laboratory study used a notched beam test to measure the effectiveness of 30 different surface active agents on the amount of surface energy required to cause stable fracture in rock specimens, with promising results. It would appear



that stress activated corrosion is the principal mechanism responsible for rock weakening. Indications are made for further efforts in the field.

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### **RIPRAP SLOPE PROTECTION FOR EARTH DAMS: A REVIEW OF PRACTICES AND PROCEDURES**

Bureau of Reclamation. E. J. Davis, L. R. Burton, A. B. Crosby, L. D. Klein, and E. R. Lewandowski. March 1973. 28 pages.

#### **PB-219 834**

Upstream slope protection for earth dams is usually provided by riprap rock application, but rational design formulas available to designers for wave heights have given extremely variable results for the size of rock required for riprap. It is thought, however, that a 36-inch blanket of riprap graded up to 1 cubic yard in size is about the maximum protection to be obtained in the structures under consideration. The report discusses practices and procedures for investigation, sampling, testing, and field control of riprap slope protection for earth dams. Approximately 50 case histories of this protection were studied, with the conclusion that original and lifetime maintenance costs constitute the predominant factor in selecting, designing, and constructing the upstream slope protection. Detailed instructions to investigators of riprap are included.

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### **LOCATION OF SOLUTION CHANNELS AND SINKHOLES AT DAM SITES AND BACKWATER AREAS BY SEISMIC METHODS: PART 1—ROCK SURFACE PROFILING**

University of Kentucky Water Resources Institute. Vincent P. Drnevich. 1972. 50 pages.

#### **PB-220 063**

When slightly acid ground water comes into contact with a geologic limestone deposit, a chemical reaction occurs and caves, sinkholes, and channels result. The main objective of study was to adapt the methods of seismic refraction surveying to the accurate determination of depth and undulation of rock surface when the depth to rock is less than 50 feet. The particular aim was to locate solution channels and sinkholes in the limestone beneath potential dam sites and backwater area. Basic concepts associated with the sledge hammer seismic refraction method are reviewed, and a modified version called down hole shooting is discussed. A digital computer simulation is described which can handle any shaped rock surface profile to generate corresponding travel time curves for forward and reverse profile surveys. Field tests are discussed at

four sites having different soil and rock characteristics. Typical results are given, the sources of error are noted, and some limitations of use are observed.

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Civil Engineering  
(continued)

### **LOCATION OF SOLUTION CHANNELS AND SINKHOLES AT DAM SITES AND BACKWATER AREAS BY SEISMIC METHODS: PART 2:— CORRELATION OF SEISMIC DATA WITH ENGINEERING PROPERTIES**

University of Kentucky Water Resources Institute. Vincent P. Drnevich. 1972. 36 pages.

#### **PB-220 064**

The location of sinkholes and channels formed on the surface of underground limestone formations by the action of slightly acid ground-waters has prompted the development of seismic refraction surveying of rock faces less than 50 feet below a construction site level. A previous report (PB-220 063, above) outlined the general methodology. The present one is concerned with a statistical analysis of the refraction survey information with regard to the useful engineering properties of soil and rock. Four seismic tests and a laboratory investigation are described for determining shear wave propagation velocities and shear moduli for two sites. The four seismic methods were standard seismic refraction survey, down hole shooting refraction survey, transient Rayleigh wave survey, and crosshole shooting survey. A torsional resonant column apparatus was used for the laboratory tests, with cross hole shooting giving the best results because direct measurements were made. Criteria for using this method are given. Strength and time effect corrections were applied to the laboratory data and comparisons were made with the field data.

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### **DESIGN OF EMBANKMENTS ON SOFT SOIL**

Massachusetts Institute of Technology, Department of Engineering. Robert D. Kiny, and T. William Lambe. July 1972. 133 pages.

#### **PB-221 421**

A proper design of an embankment on soft soil must meet two requirements: Avoid a bearing rate capacity failure, and keep the magnitude and rate of settlement less than some allowable value. This document develops a methodology that would ensure that bearing capacity failure does not occur during undrained loading. The key to a design that ensures stability is an accurate prediction of stability. The logical procedure for evaluating the ability to predict the factor of safety is to evaluate the method of analysis, the soil engineering data that must be input into the analysis, and



then the predicted factor of safety of an embankment on clay. All these topics are considered in the document. Construction control is an important part of the design of embankments on soft soil and therefore the uses and limitations of field measurements for construction control are reviewed and summarized.

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### **A STUDY AND ANALYSIS OF TIMBER CRIB RETAINING WALLS**

University of Idaho, College of Engineering. R. L. Schuster, W. V. Jones, S. M. Smart, and R. L. Sack. April 1973. 198 pages.

#### **PB-221 427**

Road construction in steep terrain may require earth-retaining structures to stabilize cut and fill slopes, prevent extensive scarring of hillsides, and minimize stream encroachment. The retaining wall should be economical to construct and use locally available materials as much as possible. In forested areas, it would be desirable to use retaining structures incorporating forest products if such walls are competitive with manufactured materials such as concrete, steel, wire, etc. This document provides an evaluation of the use of, and the design criteria for, timber retaining structures made from dimensioned timber and backfilled with suitable locally available soils. This includes attention to structural quality of timber members and connecting devices, to suitability of the soils as cribfill and backfill, and to the effect of settlement and differential wall movements on stresses in the timber members and connecting units. In addition, a brief review of cost comparisons between timber crib walls and other types of walls is provided.

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# COMMUNICATION

## TECHNOLOGICAL INNOVATIONS IN VIDEO AND THEIR POTENTIAL MARKET, INSTITUTIONAL AND CONSUMER IMPACTS

University of Denver, Denver Research Institute. Paul I. Bortz, Eric F. Jaeckel, and Fred P. Venditti. February 1973. 140 pages.

**COM-73-11455**

Because of the number and diversity of potential innovations affecting video, a comprehensive review can provide a useful perspective to those concerned with the future of this form of communication and its applications. This report discusses potential technological innovations that might be introduced within the next ten to twenty years. Approximately 100 technical items, grouped into 36 categories of innovation, are reviewed briefly in terms of stage development, estimated time of introduction, and potential market impact. Five innovations that may be commercially introduced within the next decade are treated in greater detail with respect to technical feasibility, market description, and institutional and consumer impacts. These innovations are video recording and playback techniques; interactive home terminals; high selectivity television, that is, television with an increased ability to reject interfering signals; still picture transmission; and high-resolution television. Some institutional, regulatory, and social factors applying to all five innovations are discussed.

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## SINDI 1: SIMULATION OF INFORMATION DIFFUSION IN A PEASANT COMMUNITY

Michigan State University, Department of Communications. Gerhard J. Hanneman, and Tom W. Carroll. June 1970. 110 pages.

**PB-216 772**

The use of simulation techniques in studies of the diffusion of innovations is discussed in this document. A stochastic computer model (SINDI 1) of the diffusion of information about an innovation is described in detail. The model assumes that this information enters a village through external interpersonal channels. In SINDI 1 there are two such channels—an extension agent and a local school teacher. During the simulation each channel randomly contacts members of the village. The peasants are divided into clagues, with a higher rate of information transfer within clagues than between clagues. The model was validated against data available for the small Colombian peasant village of Pueblo Viejo. Several simulation runs using SINDI 1 are described, and possible future applications are discussed.

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# **COMPUTERS AND INFORMATION SCIENCES**

## **USE OF COMPUTERS IN EDUCATION: A BIBLIOGRAPHY**

Defense Documentation Center. July 1973. 201 pages.

**AD-764 650**

The bibliography contains abstracts of reports of U.S. Government-funded research on the use of data processing systems in education, as well as the use of computer-aided instruction for the motivation and training of students. Major topics are teaching machines and methods, training devices and methods, and learning characteristics. Various fields of application are included, such as electronic technician courses, reserve officer training, social simulation games, anxiety analysis, attitude changing, foreign language learning, teacher training, decision making, medical education, and management training. A complete set of indexes is included. The reports listed in this bibliography are available from NTIS (prices on request).

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## **AN INTRODUCTION TO COMPUMETRICS**

Brown University. Ulf Grenander. July 1973. 144 pages.

**AD-766 470**

As computing systems grow in size and in complexity it becomes increasingly difficult to describe their performance in a lucid and effective way. At the same time the need for such an analysis has been accentuated, both for the manufacturer and for the prospective buyer. The problem has received a good deal of attention in recent years and is at present a highly active area of computer science. The term "compumetrics" has been applied to this emerging science of the performance of computing systems. The term implies the emphasis on quantitative methods—analytic, simulation, and empirical. This document provides the first systematic introduction to the subject in the English language.

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## MICROFICHE VIEWING EQUIPMENT GUIDE

Defense Documentation Center. Ronald F. Gordon. September 1973. 167 pages.

### AD-767 500

A descriptive directory is given of microfiche viewers and viewer-printers that are manufactured or distributed in the United States. General evaluation criteria are outlined to assist the potential buyer. Features and specifications are uniformly listed to aid comparison. A few of the characteristics called to attention are focus and lamp life, noise level and operating temperature, loading, and jam-proof operation. Some of the feature terms cited are lenses, fiche size, screen size and type, positioning controls, warranty period, and accessories; 92 models are surveyed, arranged by supplier.

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Computers and  
Information  
(continued)

# **EARTHQUAKE ENGINEERING**

## **A COMPUTER PROGRAM FOR EARTHQUAKE ANALYSIS OF GRAVITY DAMS INCLUDING HYDRODYNAMIC INTERACTION**

University of California, Earthquake Engineering Research Center. P. Chakrabarti, and Anil K. Chopra. May 1973. 56 pages.

**AD-766 271**

The development of the finite element concept has led to effective methods and computer programs for analyzing the response of dams to earthquake ground motion. In the report the dam is considered as a finite element system, and the water in the reservoir as a continuum of infinite length in the upstream direction governed by the wave equation. The dam-water system is idealized as two-dimensional in geometry, the material behavior is assumed to be linearly elastic, and the components of ground motion considered are transverse horizontal and vertical. Compressibility of water is considered, involving the excitation frequency. Analysis is performed in the frequency domain, first obtaining the frequency responses, then synthesizing and transforming by Fourier procedures to obtain responses to arbitrary ground motion. The computer program is described, and its use, limitations, and timing are noted. The computer program is also listed.

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## **EARTHQUAKE ANALYSIS OF STRUCTURE-FOUNDATION SYSTEMS**

University of California (Berkeley), College of Engineering. Ashok K. Vaish, and Anil K. Chopra. May 1973. 137 pages.

**AD-766 272**

It has become generally recognized that the earthquake response of a structure is related to its dynamic interaction with the foundation. The report notes that for major structures such as multistory buildings and dams, a rational earthquake analysis must include the effects of this interaction. For such analysis mechanical models are helpful but limited. The study aims at developing numerically efficient finite element techniques that can be used for general structure-foundation systems. A computationally effective procedure is developed for the linear earthquake analysis of complex structures based on large layered foundations. An explicit formulation is presented for the plane strain idealization of a dam, using a substructure approach. The foundation is analyzed first to ob-

tain its frequency characteristics, the approach allowing detailed modelling of the structure and providing flexibility in numerical computation. Then the frequency dependent equations of motion for the structure are used to express the structural response.

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### **RESEARCH PAPERS SUBMITTED TO WORLD CONFERENCE ON EARTHQUAKE ENGINEERING (5TH), ROME, ITALY ON 25 - 29 JUNE 1973**

California Institute of Technology. March 1973. 106 pages.

#### **PB-220 431**

A series of papers on earthquake problems and engineering is presented. Seismic zoning maps are discussed for utility and the data contained, and some recommendations are made. Factors influencing the local distribution of strong earthquake ground motions are considered, along with accelerogram measurements at an actual earthquake site in California. Strong motion accelerogram technology is reviewed with reference to instrument resolution, data handling, and magnetic tape techniques. An examination is made of recent developments in data processing and accuracy for acceleration measurements, with particular attention to overcoming errors. An analytical model is constructed for the dynamic load deflection behavior of deteriorating structures, containing elements to describe perfectly elastic, elastic-plastic, or simple coulomb slip response. Other presentations cover earthquake induced earth pressures on retaining walls, ambient vibration tests of full scale structures, computation of individual Fourier spectrum ordinates, the 1971 San Francisco earthquake, and characterization of response spectra by parameters for earthquake source mechanisms.

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### **EFFECTS OF TWO-DIMENSIONAL EARTHQUAKE MOTION ON A REINFORCED CONCRETE COLUMN**

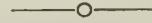
University of Illinois, Department of Civil Engineering. A. E. Aktan, D. A. W. Pecknold, and M. A. Sozen. May 1973. 141 pages.

#### **PB-220 891**

A 1971 earthquake in California provided data important to earthquake resistant design concepts. Investigation of the effects showed that extreme damage had occurred to many modern structures designed and built according to standard seismic code provisions. The conclusion had to be made that existing laboratory and analytical representations of structures and earthquake conditions are deficient. Effects of multidimensional interaction on the dynamic response of reinforced concrete have received virtually no attention. The reported study was carried out to obtain information on the static and dynamic multidimensional response of



reinforced concrete. A finite-filament model was developed that assumes a column segment consists of filaments along its long axis and that traces the system properties through stress-strain-hysteresis characteristics. A summary and general conclusions are given for the study of dynamic response to two-dimensional earthquake motion of reinforced concrete columns in the inelastic range.



# **ECONOMICS OF DEVELOPMENT**

## **TRADE AND EMPLOYMENT: INDUSTRIAL EXPORTS COMPARED TO IMPORT SUBSTITUTION IN MEXICO**

Williams College, Center for Development Economics. John Sheahan. December 1971. 32 pages.

**PB-215 971**

The report discusses the effectiveness of investment in a developing country aimed at promoting export industry in preference to replacing imports. It is postulated that such export development should provide more employment than import substitution, although a variety of problems produce complications. If a prime commodity for export is produced with abundant labor and other optimum factors but is unable to compete in price with that of another nation, satisfactory export cannot occur. A high demand export item may be infeasible because it requires highly skilled labor that is short in supply. A foreign producer by successive technology improvements may continue to undersell the home producer in spite of his advances. Finally, if all other interferences turn out to be minor, domestic prices and costs may disrupt any employment effects of international trade. Attention is directed to the export import statistics of Mexico for 1960, 1964, and 1968. Data are cited for certain manufactures and industries, and an economic analysis is made of export over import substitution data with regard to income produced and employment. The possibilities offered by subsidies as incentives to investment are noted.

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## **WAGE SPILLOVER AND UNEMPLOYMENT IN A WAGE GAP ECONOMY: THE JAMAICAN CASE**

Williams College, Center for Development Economics. Gene M. Tidrick. June 1972. 37 pages.

**PB-215 972**

An examination is made of the unemployment economics in underdeveloped countries as influenced by wage structures, with particular reference to problems involved in reducing unemployment. Conditions in one nation, Jamaica, are analyzed as an example of a situation where workers of the same skill will receive different wages according to the industry in which employed. Moreover a wage gap between the high-wage modern sector and the rest of

the economy in such a nation is observed to cause both slow employment growth nationally and high unemployment. It is postulated that if less developed countries are to make head way in solving their employment problems, they must take new policy measures, including higher taxes or lower tariffs, to spread the benefits of rising incomes. The paradox of a poor nation, Haiti, which suffers less unemployment than its richer neighbors, is cited. A statistical study is made of wages in Jamaican mining and sugar, and a wage gap model is derived in the direction of obtaining improvement.

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### **WAGE CHANGE AND EMPLOYMENT GROWTH IN LATIN AMERICAN INDUSTRY**

Williams College, Center for Development Economics. John R. Erikson. June 1970. 34 pages.

#### **PB-215 973**

The problem of inadequate employment growth to match rapid urban population growth in developing countries has been drawing increased attention, and recent case studies have examined the effect of rapid wage increases on industrial manpower. The report deals with the quantitative influence of wage changes and related factors on employment growth in the manufacturing sectors of five Latin American countries; Argentina, Brazil, Colombia, Costa Rica, and Mexico. These nations, the largest in population, excepting Costa Rica, in Latin America were chosen on the basis of data availability. Broad lines of industrial employment are sketched, and a theoretical model of employment growth is developed. The methodology for confronting the model with empirical data is discussed along with data limitations, following which possible policy implications are noted.

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### **CAPITAL UTILIZATION: PHYSIOLOGICAL COSTS AND PREFERENCES FOR SHIFT WORK**

Williams College, Center for Development Economics. Gordon C. Winston. October 1971. 32 pages.

#### **PB-215 997**

A subject of continued concern in industrial management is the use of shift work schedules. The physiological effects of shift work, involving change in the functional rhythms of the body associated with the time of day, are still largely uncertain. No data are available from the underdeveloped countries on shift work attitudes, preferences, or social effects, but the report examines advanced country evidence for possible use by developing nations. Of special relevance to poor countries are data indicating that for many workers the physiological and psychological costs of shift work are negligible; that a fixed shift work schedule is less



costly to workers than a rotating shift schedule; that an afternoon shift can be added to a day shift with virtually no cost to workers; and that concentration of shift working, either geographically or at a particular time, sharply reduces its social cost. The effect of sleep vs. daytime noise is discussed at some length, along with motivation.

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## THE NORMAL DEVELOPING ECONOMY

Harvard University, Center for International Affairs. Hollis B. Chenery. September 1970. 87 pages.

### PB-216 014

As a pattern for economic development which may be of value to developing nations, the report describes the transition of a national entity from a primitive society to a developed economy in terms of 10 basic sets of processes. Four of these sets are emphasized: Education of the population, accumulation of money adequate to sustain growth (2% per capital or more), attainment of the production and labor allocation necessary to balance internal and external demand, and control of the birth rate and population growth. Twenty-three nations that had accomplished the transition by 1970, such as the United States, Great Britain, the USSR, Japan, Israel, and Puerto Rico, are cited. Tables of statistical data on savings, investments, and revenues are presented, along with regression analyses of resource allocations, growth sources, and factor values. Several curves of development in specified lands are included, such as literacy, domestic demand, exports, and vital statistics. Nations that are approaching the transformation are discussed, but no formal economic models are attempted.

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## IMPROVEMENT OF LABOR QUALITY AND ECONOMIC GROWTH—POSTWAR JAPAN'S EXPERIENCE

Harvard University, Center for International Affairs. Tsunehiko Watanabe. October 1970. 74 pages.

### PB-216 023

The relatively higher rates of economic growth that have been experienced in the most advanced countries since 1945, compared with the relatively slower growth in the developing countries, invites inquiry into the sources of economic growth. This paper considers one aspect of this problem by investigating the Japanese experience with regard to relationships between improvements in labor quality and economic growth during the period 1952-69. Attention is given to the stability of wage differentials; the composition of labor force in Japan; estimates of the labor quality indices; and the labor quality index by industry and the size of firm. Since education is linked with labor quality, quantitative

assessments are made of the relationships between educational efforts and economic growth in postwar Japan. The rate of return to education is discussed in some detail.

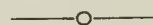


### **BENEFIT-COST ANALYSIS OF FOREIGN INVESTMENT PROPOSALS. THE VIEWPOINT OF THE HOST COUNTRY**

Harvard University, Development Advisory Service. Daniel M. Schydlosky. June 1970. 48 pages.

#### **PB-216 031**

There is widespread consensus that the policy of less developed countries toward foreign private investment is an important part for their general strategy for economic development. From the viewpoint of the developing country, foreign investors are often seen as bringing in scarce resources, but many times also are preempting investment opportunities from domestic entrepreneurs, as removing a sector of the economy partially from the effective policy influence of the country's government, and as imposing constraints on the general economic policy of the country through the possibility of sanctions on the part of the country whence the foreign investors come. Clearly host governments require tools by which to appraise the merits of specific investment proposals made by foreign enterprises. In this paper, the foreign investment proposals confronting a country are divided into two types: Those involving alternative forms of operating within a sector and those implying choice between different sectors. For the former, the net present value criterion is suggested as appropriate; for the latter, the domestic resource cost of foreign exchange is preferred. The relation of this last criterion to the social marginal productivity of capital is also discussed.



### **CAPITAL INTENSITY, ABSOLUTE SIZE, AND GROWTH RATE OF THE SMALL INDUSTRIES SECTOR IN INDIA: A CRITIQUE OF OFFICIAL ESTIMATES**

Cornell University, Department of Agricultural Economics. Jan H. van der Veen. July 1972. 39 pages.

#### **PB-219 689**

To evaluate the official estimates of development in India's small industries it is necessary to examine the procedures adopted for collecting the data and to understand the assumptions on which the estimates are based. A nomenclature problem involves "Reg-

istered" units—those manufacturing units compulsorily registered under law, and "Unregistered" units—manufacturing units too small under the employment criteria of the Factories Act to be registered, either employing fewer than 10 workers in a powered plant or fewer than 20 workers if the unit does not use power. Estimates show that the "Unregistered" units have contributed more than 35% of India's gross product. Also, "Small scale" units—those having a total investment not exceeding 750,000 rupees—have contributed approximately 52% of the gross product. As a result, the potential employment effect of these small industrial units is great. The report discusses the capital planning approach, the national level income approach, and the state level income approach to economic analysis of these industries in India.

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### **THE RELEVANCE AND PROSPECTS OF SMALL-SCALE INDUSTRY IN COLUMBIA**

Yale University, Economic Growth Center. R. Albert Berry. April 1972. 139 pages.

**PB-219 744**

A review is provided of some of the evidence relating to the possible contribution that small-scale industry can make in Columbia. Factors that appear to have affected the growth (or stagnation) of small-scale industry are discussed, and some tentative suggestions are made concerning policies for fostering desirable growth in this area. A brief description is given of small-scale industry in Colombia and how it appears to have developed in past years. Consideration is then given to its performance in terms of actual and potential "static" efficiency, i.e., the efficiency with which it converts resources into output at a given point in time; and employment and income distribution impact. The growth potential of this sector relative to larger scale industry is discussed; pertinent information on several other countries is mentioned. Finally, possible strategies for small-industry development are suggested.

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### **THE COST AND COMPOSITION OF INDIAN EXPORTS**

University of Michigan, Center for Research on Economic Development. Charles P. Staelin. May 1972. 43 pages.

**PB-224 231**

It is recognized that economic development by means of import substitution can be both costly and ineffective, but only lately has realization grown that export promotion can have the same result.



The report deals with the effects of mishandled export promotion. The case of India is cited, not that export promotion has been unjustified in that country, but that export incentives appear to have been as poorly handled there as import substitution policies. The study proceeds to demonstrate the feasibility of using a domestic resource cost concept—also known as the domestic cost of foreign exchange concept—as a practical planning tool in a less developed country where linear programming models are not usable. Using this concept as the criterion for measuring relative export efficiency, the present structure of Indian exports is examined on both the sectoral and product level, and some conclusions are drawn. Some statistical data are included, and a mathematical model is developed.

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# EDUCATION

## PROGRAMMED INSTRUCTION AND TEACHING MACHINES, A BIBLIOGRAPHY

Defense Documentation Center. August 1973. 286 pages.

### AD-765 450

The bibliography contains abstracts of reports of US Government-funded studies on programmed and computer aided instruction as they relate to efficient learning in military and civilian training. Main categories of interest are teaching machines, teaching methods, learning processes, man-machine systems, training devices, military training, and computer technology. Some of the particular topics covered are information systems, cybernetics, television systems, programming languages, confidence testing, curriculum development, audiovisual equipment, individualized instruction, training models, simulation; data storage, processing, and transmission; educational psychology and motivation, and automatic control. The reports listed in this bibliography are available from NTIS (prices on request).

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## MODELS FOR BILINGUAL EDUCATION

Evaluation, Audits and Systems in Education. Charles F. Leyba, and Jeanne M. Guertin. February 1973. 195 pages.

### PB-220 820

Bilingual-bicultural education has begun to draw the attention of researchers and practioners as a replacement for the traditional method of instructing children in a foreign language. Use of two languages, one foreign and the other native, simultaneously in the classroom is seen as productive and socially beneficial. The child is initiated into the school environment in the language he brings from home and he is helped to develop that language. Presentation of subject matter and concepts in both languages fosters better understanding. The child develops or maintains pride in his cultural heritage while he acquires a positive attitude toward the cultural heritage of others. The report is based mainly on a literature review in which two dimensions were noted: The objectives of instruction based on community patterns of language usage, and the context within which learning takes place in school. Twelve models were developed by systematically varying the factors identified in these two dimensions, leading to a number of objectives which are discussed.

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## HIGHER EDUCATION IN AGRICULTURE IN NEPAL

Midwest Universities Consortium for International Activities, Inc.  
August 1972. 219 pages.

**PB-224 291**

Nepal is a nation 90% dependent upon agriculture with only 12% cultivable land. Its people are characterized by great ethnic differences, continuance of a caste system, and division by geographic barriers, along with limited government resources. Exceptional study is required, therefore, if outside technical assistance is to be effective, since furtherance of economic growth of such a nation must depend principally upon advances in agricultural technologies, dependent in turn upon programs of education and training. The report considers the current situation in Nepal with respect to higher education in agriculture and explores alternatives with regard to change, discusses the feasibility of change, and indicates what might be done. Recommendations are made for the development of higher education in Nepal, with emphasis on practical and applied aspects of agriculture. Also, a strategy of international cooperation in achieving an effective system is indicated.

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# ENERGY SOURCES

## **SOLAR CELLS AND SOLAR PANELS: A BIBLIOGRAPHY**

Defense Documentation Center. October 1973. 177 pages.

### **AD-768 400**

The bibliography contains abstracts of reports resulting from US Government-funded research on solar panels and solar cells. The reports concern performance characteristics, fabrication, development of power levels, degradation studies of the cells, and systems for orienting the panels continuously toward the sun. A few of the topics in interest are coatings and crystals, semiconductors, thermionic emission, plasma physics, space environmental conditions, specific metals and chemical compounds, solar radiation, phototubes, power supplies, and degradation. A complete set of indexes is included. The reports listed in this bibliography are available from NTIS (prices furnished on request).

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## **BATTERIES: A BIBLIOGRAPHY**

Defense Documentation Center. October 1973. 270 pages.

### **AD-768 500**

The bibliography contains abstracts of reports resulting from US Government-funded research on battery design, cells, tests, development, components, and performance. Many types of batteries are discussed, with particular attention to nickel cadmium and organic varieties. Several of the key topics covered are power supplies, dry cells, reliability, electrodes, electrolytes, fuel cells, spacecraft components, water activation, separators, and organic compounds. Discussions are included of nonaqueous solvents, low temperature operation; silver, zinc, and magnesium systems and compounds; storage; and various other metals and compounds. A complete set of indexes is included. The reports listed in this bibliography are available from NTIS (prices furnished on request).

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## ENERGY AND DEVELOPMENT: A CASE STUDY

Massachusetts Institute of Technology. William W. Seifert, Mohammed A. Bakr, and M. Ali Kettani (Eds.). 1973. 320 pages.

**COM-73-11500**

Saudi Arabia is making a major attempt to broaden the base of its economy. The report discusses two programs that appear promising in development of the Persian Gulf region. One is steps to use the 2 billion cubic feet per day volume of natural gas that comes to the surface with oil produced. The second relates to the possibilities for hydroelectric power generation resulting from construction of a causeway, dam, and reservoir affecting the region from the east coast to Bahrain and Qatar. To appraise the possibilities for using the natural gas now being flared, an examination was made of possible processes, including the production of aluminum, magnesium, and fertilizer for export, and steel, cement, and glass for domestic consumption. Considerable detail is given for each of these. With regard to the dam and causeway, the benefits that might accrue to the nation are listed as a road upon the causeway to link centers of population, a chemical industry based on precipitation of salt on Dawhat Salwah shores, reclamation of land from the sea, and the culture of brine shrimp and algae in the evaporation reservoir.

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## GEOTHERMAL ENERGY

University of Alaska. Walter J. Hickel. November 1972. 92 pages.

**PB-216 423**

A potential energy source that has heretofore been greatly underused is the natural heat of the earth—geothermal energy. Temperature measurements in drill-holes, mines, etc. confirm that, on average, temperature increases with increasing depth. Theoretically, this energy source can be tapped from any point on earth but, in reality, it is much too deep in many places to reach with present drilling technology. In other areas, however, the resource is much closer to the surface. This document surveys the potential of geothermal energy, with emphasis on the research that will be needed to fully develop this resource. The topics covered include: Amount of power potentially available from geothermal sources; classes of geothermal resources; geothermal exploration techniques; resource assessment methodology; optimal development of geothermal reservoirs and production of the resource in its several manifestations (energy, desalinated water, minerals, and process heat); utilization technology and economics; environmental effects of geothermal resources exploitation.

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# EXPLORATION AND EXPLOITATION OF GEOTHERMAL RESOURCES IN ARID AND SEMIARID LANDS: A LITERATURE REVIEW AND SELECTED BIBLIOGRAPHY

Energy Sources  
(continued)

Arizona University, Office of Arid Land Studies. 1973. 119 pages.

**PB-218 830**

Geothermal energy technology involves utilization of the heat existing in certain parts of the earth's crust near the surface or at depths not exceeding feasible limits. First there must be a source of heat such as a shallow intrusion or an area of recent volcanic activity. Next a water reservoir system must be present, heated by the source and prevented from escape by an impermeable rock layer or a precipitated silica cap. All present geothermal sources are found in volcanic regions associated with major fault systems. The report outlines contemporary techniques for exploration of such geothermal resources, with particular emphasis on operations in semiarid and arid lands. A review of the literature is presented in an annotated bibliography. The various topics discussed include field reconnaissance and mapping; fluid dynamics of natural streams; seismic, gravity, and magnetic surveys; heat flow, steam, and thermal power; well drilling, geyser fields, and terrain analysis; and economic factors. Case reference is made to western United States areas as typical of the problems encountered.

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## HERBIVOROUS FISH FOR AQUATIC PLANT CONTROL

U.S. Army Engineers Waterways Experiment Station. E. O. Gangstad, J. J. Raynes, R. M. Buress, et al. June 1973. 154 pages.

**AD-765 437**

Research to discover means of controlling obnoxious aquatic plant growth has included evaluation of various species of herbivorous fishes. One of these fishes, the white amur fish (*Ctenopharyngodon idella*), has shown great promise in controlling submersed and emersed types of plants. This report provides a review of research undertaken to determine the efficiency of *C. idella* as a biological control agent for aquatic weed populations in natural habitats, with concurrent evaluation of space and plant nutrients resulting from the destruction of weeds in the aquatic ecosystem. This research information forms a basis to establish a system of knowledge for control and operational procedures for the use of this fish species for aquatic plant control. Appended to the report is a series of papers dealing with such topics as: Production of all-female populations of *C. idella*; spawning and rearing of *C. idella*; food preferences of *C. idella* and its growth on selected aquatic plants; interactions of *C. idella* with other fish species; induced spawning of *C. idella* and *Hypophthalmichthys molitrix* in ponds at Cuttack, India; Chinese experience with the food habits and nutrition of *C. idella*.

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## ANNOTATED BIBLIOGRAPHY ON EFFECTS OF SALINITY AND SALINITY CHANGES ON LIFE IN COASTAL WATERS

Texas A and M University. Sewell H. Hopkins. August 1973. 416 pages.

**AD-767 562**

The bibliography is intended for use in estimating the probable ecological effects of engineering projects, but should be helpful to physiologists and ecologists interested in coastal life as affected by the entrance of fresh or sea water into coastal water bodies. Some of the topics covered are the salinity tolerance of plants, algae, plankton, and various organisms; reproduction, survival, and development of clams, mussels, oysters, and molluscs; crab, shrimp, and prawn data; fish survival, effects, and mortality; sand and mud communities, lake and estuary ecology, fungus encroach-

ment, osmotic and ionic regulation in aquatic animals; larvae studies; forms, eels, and snails; and temperature changes and tolerance. References and abstracts are given for about 1400 published and unpublished reports, dated 1972 and earlier, on the physiological and ecological effects of salinity and salinity changes.

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## **SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT**

Mitre Corporation. May 1972. 506 pages.

### **PB-216 836**

A 1972 symposium held in France dealt with the present and future relationships of energy and the environment, and the relation of world resources to both. The report contains a transcript of the proceedings from the six panels comprising the meeting. The general headings of the discussion include economic development, environmental issues, international issues, and ethical considerations. Examples of the topics discussed are the long-term biological effects of thousands of organic components added to the biosphere every year, long-term radiation effects of krypton, tritium, and nuclear wastes, problems with trace pollutants and possible degradation of the ozone layer by nitrous oxides, heat loads from energy sources, and global thermal concerns regarding carbon dioxide. The Plowshare nuclear excavation program received especial attention. Participants came from the US and Western European countries.

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## **PCB IN WATER—A BIBLIOGRAPHY**

U.S. Department of the Interior, Water Resources Scientific Information Center. March 1973. 150 pages.

### **PB-217 859**

Polychlorinated biphenyls (PCB) are widely used in industry and agricultural. These toxic chemicals are now found in natural ecosystems, sometimes with very serious results. This publication provides bibliographic citations and abstracts of the available literature on the occurrence and consequences of PCB in natural waters. Subject and author indexes are included.

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## **IDENTIFICATION AND CLASSIFICATION OF COMBUSTION SOURCE EQUIPMENT**

Processes Research, Inc. C. O. Bieser. February 1973. 81 pages.

### **PB-218 933**

This report identifies and classifies types of stationary fuel-burning equipment that can produce air pollutant emissions. Approximately

130 types of equipment are classified by technical and functional features. Also, a detailed analysis and classification is provided for two types of such equipment: gas turbines and kilns. These are classified into types and subtypes according to such factors as fuels burned, unit size, processes and industries in which used, products for which applied, manufacturers of the equipment, and other appropriate elements. A discussion of the relative importance of the processes as sources of nitrogen oxides is included.

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### **MONITORING INSTRUMENTATION FOR THE MEASUREMENT OF SULFUR DIOXIDE IN STATIONARY SOURCE EMISSIONS**

TRW Systems Group. Fredric C. Jaye. February 1973. 130 pages.

#### **PB-220 202**

This document provides a logical review of commercially available sulfur dioxide monitoring instruments and specifications in terms of established use criteria, selection, and procurement of the most promising instruments. A field test program, where the instruments were installed and operated continuously under real, fixed combustor stack conditions, is also reported upon. Instrument performance was rated on criteria that included accuracy, specificity, reliability, maintainability, ruggedness, and other selected performance characteristics. The performance evaluations and the data collected should be of assistance in the intelligent selection of monitoring equipment for a specific application.

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### **ENVIRONMENTAL EXPOSURE TO NONIONIZING RADIATION**

American Public Health Association, and U.S. Environmental Protection Agency. May 1973. 143 pages.

#### **PB-220 851**

Much attention is being devoted to evaluation of the exposure of man to ionizing and nonionizing radiation and to developing controls to protect public health and safety as well as to assure environmental quality. A report is made on presentations in a symposium session on nonionizing radiation exposure. The papers were on management of the radio spectrum; electromagnetic environments in urban areas; recommendations for standards in various countries about the world; electromagnetic compatibility; interference, and susceptibility as related to medical devices; microwave systems and applications; space solar power as an option for power generation; and a national program on the biological effects of electromagnetic energy.

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# **FISHERIES AND AQUACULTURE**

## **REFRIGERATION SYSTEMS ON SMALLER FISHING VESSELS**

University of Washington, Vocational Technical Institute. John P. Ronning. 1973. 20 pages.

### **COM-73-11272**

The main reasons for considering a refrigeration system for commercial fishing vessels are to maintain high product quality, conserve ice, extend fishing trip length, and decrease labor. This publication is intended to assist fishermen to better understand the suitability and use of refrigeration equipment to hold and freeze the catch. It covers a general consideration of the selection and use of refrigeration systems for fishing vessels and describes the basic kinds of equipment that are available and that has been used in various fishing operations. Some advantages and disadvantages of the systems are compared as to equipment costs, installations, maintenance, and effectiveness in different fishing operations.

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## **GULF AND CARIBBEAN FISHERIES INSTITUTE. PROCEEDINGS OF THE 25TH ANNUAL SESSION, MIAMI, FLORIDA, NOVEMBER, 1972.**

University of Miami, Rosentiel School of Marine and Atmospheric Science. James B. Higman (Ed.). May 1973. 189 pages.

### **COM-73-11300**

This document is comprised of papers presented at the Institute session. The topics covered include: Progress of law in the sea as applied to fisheries; Mexico's concept of the patrimonial sea; US-Brazil shrimp conservation agreement; investigations and management of the Guianas shrimp fishery under the US-Brazil agreement; impact of international standards on fisheries products; developments in nutritional labeling; defrosting shrimp with microwaves; rock shrimp quality as influenced by handling procedures; estimating abundance of sardine-like fishes from egg and larval surveys; quality control as a solution to fish inspection; effect of sanitation procedures on bacterial levels in blue crab processing plants; total use of fishery products; large volume stackable fish traps for offshore fishing; present status of the exploitation and

evaluation of fishery products in Venezuela; observations on the fishery and biology of pink spotted shrimp, *Penaeus brasiliensis*, of Margarita Island, Venezuela; the potential of pollutants to adversely affect aquaculture; innovations in coastal management; developing a marine sport fish statistics program.

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### **PROGRESS REPORT ON FISHERIES DEVELOPMENT IN NORTHEASTERN BRAZIL. I. AQUACULTURE**

Auburn University, International Center for Aquaculture. N. B. Jeffrey. September 1972. 10 pages.

**PB-224 225**

Construction was begun in 1969 on a modern fishcultural experiment station in Ceara, Brazil. This report briefly describes the station and discusses the research program undertaken there. A total of 20 species of endemic and introduced species of freshwater fishes and shrimps was studied. Various levels of fish cultures were evaluated, including natural production, organic and inorganic fertilization, and feeding of prepared rations made with locally available materials.

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### **RELATIONSHIP OF THE THAI FISH CULTURE PROGRAM TO PRODUCTION OF FISH IN THE LOWER MEKONG AREA**

Auburn University, International Center for Aquaculture. H. S. Swingle. February 1972. 17 pages.

**PB-224 365**

This document provides the results of recent research activities of the Thailand Department of Fisheries Stations and Research Units. This work has involved the development of fish culture methods for use in hatcheries, rice fields, ponds, cages, pens, and irrigation ditches that can be utilized in rapid expansion of fish production as irrigation water is made widely available from Mekong impoundments. It has also included the determination of the feeding habits of many indigenous species to facilitate selection of species capable of utilizing the various types of natural fish-food organisms in various habitats.

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## LAKE NICARAGUA FISHERIES SURVEY

Auburn University, International Center for Aquaculture; and Agency for International Development. William D. Davies, and Philip C. Pierce. June 1972. 53 pages.

**PB-224 415**

This document summarizes the observations and recommendations resulting from a fishery survey made on Lake Nicaragua in February and March 1972. The survey was made to assess the economic potential of the fishery resources and to provide assistance in developing a realistic program of catch assessment, management, and extension for the fisheries program on Lake Nicaragua. Included in the report are: A brief description of the geography and climate of the region; population, nutrition, and fish consumption; government divisions responsible for fisheries; water resources, distribution of fisheries, fishing activities, and the freshwater shrimp fishery of Nicaragua; characteristics of Lake Nicaragua; status of Lake Nicaragua's fishing industry (sawfish and shark fishery; guapote, mojarra, and gaspar fishery; and sport fishing); investigational program recommended for Lake Nicaragua.

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Fisheries and  
Aquaculture  
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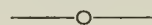
# FOOD AND NUTRITION

## THE COMPRESSION OF FREEZE-DRIED BEEF TO FORM BARS; PLASTICIZING WITH WATER TRANSFERRED AS A VAPOR

U.S. Army Natick Laboratories. Malcolm N. Pilsworth Jr., and Harold J. Hoge.

**AD-766 709**

Much interest is being devoted to the production of freeze-dried foods, and the advantages gained by reducing both weight and volume. A considerable body of information gained on the subject includes the finding that to avoid crumbling or poor appearance, freeze-dried foods must be plasticized by the addition of a small amount of water, especially if the food is to be formed into bars. The report covers the plasticizing of freeze-dried beef by such water addition and its compression into rehydratable bars, using two different sets of equipment. Water addition was accomplished by the transfer of water vapor to the meat in an evacuated system. Water proportion, time, fat content, pressure, and the use of binders are discussed. Some basic information is included on adsorption and desorption, as well as vapor pressure and the heat of vaporization of ice and volatile constituents of the beef.



## THE EFFECT OF SOYBEAN OIL SHORTENING AND COTTONSEED OIL SHORTENING ON THE SHELF LIFE OF CRACKERS

U.S. Army Natick Laboratories, Food Laboratory. Nancy J. Kelley, and Patricia Ann Prell. August 1973. 15 pages.

**AD-767 232**

This document provides the results of a comparative study of the effect of hydrogenated soybean oil and cottonseed oil on the rate of development of oxidation of crackers under prolonged storage. After storage for 24 months at 40F and 70F it was found that, although soybean oil exhibited a higher rate of increase in peroxide value, there were no taste differences. When stored at 100F, soybean oil crackers had a definite oxidized oil flavor at 12 months,

whereas cottonseed oil crackers reached the same state at 24 months. Thus the use of soybean oil shortening in crackers cannot be recommended where long-term storage at ambient temperatures are anticipated.

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### **SEAFOOD QUALITY CONTROL: A MANUAL FOR PROCESSING PLANT PERSONNEL**

Texas A and M University. Ranzell Nickelson, and Manuel Pina, Jr. June 1973. 8 pages. (Text in English and Spanish)

#### **COM-73-11524**

The quality of seafood products may be affected by many factors. People are the most important factor in the processing plant because of the large amount of human handling required there. This pamphlet is designed to answer questions, in a nontechnical language, that seafood processing plant employees might ask about the sanitation practices that they are required to follow. Consideration is given to the nature of bacteria; the importance of keeping bacteria from seafoods; the reasons that hands must be sanitized; the use of hairnets and gloves; the importance of proper cooling and fast handling of a product; problems that can be caused by improper quality control.

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### **AN ATTEMPT TO ESTIMATE RATES OF RETURN TO INVEST IN INFANT NUTRITION PROGRAMS**

Harvard University, Institute of Economic Research. Marcelo Selowsky. October 1971. 31 pages.

#### **PB-215 987**

An effort is made to quantify the economic impact of child malnutrition, and thereby draw attention to the need of resource allocation to combat this condition. The author hopes that statistical data plus ethical considerations will aid in the fight against malnutrition, particularly at preschool age. The economic impact studied is the effect of early malnutrition on the probable future economic productivity of adult individuals in the labor force. The framework for analysis is summarized in a set of mathematical relationships that may be followed as different measures of IQ through time. The case history of a group of 33 children from a very low income neighborhood who experienced strong protein-caloric malnutrition during their first year of life, and who were hospitalized and followed in a longitudinal study, is presented. At the same time 11 children rated as normal from the same neighborhood were followed as controls. The results and implications are presented, including their resistance to infectious disease.

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## **THE ECONOMICS OF MALNOURISHED CHILDREN: A STUDY OF DISINVESTMENT IN HUMAN CAPITAL**

Harvard University, Development Research Group. Marcelo Selowsky, and Lance Taylor. January 1972. 41 pages.

### **PB-216 282**

Medical evidence indicates that children who suffer from malnutrition and other environmental deprivations during infancy are likely to suffer rather severe mental retardation. Moreover, this may be "irreversible" insofar as mental capacities are formed early in life, with the possibility of large incremental changes in capacity diminishing sharply by age five or so. Since ability at this age affects both schooling performance and adult ability and earnings, one might expect that early malnutrition could significantly hinder adult economic performance. In this paper an effort is made to quantify these effects, first in terms of a simple theoretical human capital model and then numerically with data on samples of Chilean malnourished infants and adult workers. Insofar as the cross-sample inferences are valid, the economic benefits to alleviating malnutrition are substantial—a long-term program could bring discounted returns equal to one percent of current Chilean GNP. On the basis of crude cost estimates for infant feeding programs, it is also concluded that present discounted values of such programs are significantly positive.

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## **DEVELOPMENT OF A PROCESS FOR PREPARATION OF COCONUT PROTEIN PRODUCTS FOR USE IN FOODS**

Texas A and M University, Food Protein R and D Center. K. F. Mattil, C. M. Cater, J. W. Dieckert, R. Hagenmaier, and P. H. Quintio. June 1972. 36 pages.

### **PB-217 320**

Coconuts are an important agricultural crop in many tropical countries. In these countries large segments of the population consume diets that are inadequate in protein. What is needed is a commercially viable process for the recovery of food grade protein products from coconuts. This document describes progress in a project directed toward this goal (a previous progress report is available as PB-213 594; see AMTID, April 1973, page 108). A practical, economically feasible process for the simultaneous recovery of oil and food grade protein from fresh coconuts has in fact been developed. Furthermore, a product has been evolved that has the analytical properties similar to nonfat dry milk. A pilot plant, necessary for the demonstration of the commercial viability of the process in a coconut-producing country, has been designed.

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## **FOMENTING IMPROVEMENTS IN FOOD MARKETING IN COSTA RICA**

Food and Nutrition  
(continued)

Michigan State University, Latin America Studies Center. Kelly Harrison, and James D. Shaffer. January 1972. 88 pages.

### **PB-219 752**

An assessment of the current situation of the food marketing system in Costa Rica is given in this document. Based on this preliminary diagnostic review, a general program and strategy for fomenting improvements in the food system is outlined. Consideration is given to the following matters: Origins of marketing performance gains; the expanding importance of food marketing services in Costa Rica; food retaining in secondary cities and rural areas; food wholesaling in Costa Rica; developing a national fruit and vegetable wholesale market systems; feasibility of a central wholesale center; regional food marketing systems; agricultural commodity sub-systems; and price policies.

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## **GRAS (GENERALLY RECOGNIZED AS SAFE) FOOD INGREDIENTS**

Each of the documents in this series provides an extensive review of the literature on a substance or a class of substances that are considered safe for use, in proper amounts, as food additives. Included in each case is information concerning the general chemical nature of the additive; its occurrence; acute, short-term, and long-term toxicity; biochemistry; carcinogenicity; teratology; and safe levels for human consumption. Document titles and order numbers are listed below.

### **GUM ARABIC**

Informatics, Inc. June 1972. 90 pages.

### **PB-221 201**

### **BUTYLATED HYDROXYTOLUENE (BHT)**

Informatics, Inc. July 1972. 75 pages.

### **PB-221 202**

### **CAROB BEAN GUM (LOCUST BEAN GUM)**

Informatics, Inc. July 1972. 25 pages.

### **PB-221 203**

### **GUM TRAGACANTH**

Informatics, Inc. July 1972. 26 pages.

### **PB-221 204**

**STERCULIA (GUM KARAYA)**

Informatics, Inc. July 1972. 21 pages.

**PB-221 205**

**CARRAGEENAN**

Informatics, Inc. August 1972. 70 pages.

**PB-221 206**

**PROPYL GALLATE**

Informatics, Inc. August 1972. 50 pages.

**PB-221 207**

**BENZOIC ACID AND SODIUM BENZOATE**

Informatics, Inc. September 1972. 135 pages.

**PB-221 208**

**METHYL AND PROPYL PARABEN**

Informatics, Inc. August 1972. 44 pages.

**PB-221 209**

**SORBITOL**

Informatics, Inc. August 1972. 90 pages.

**PB-221 210**

**MANNITOL**

Informatics, Inc. August 1972. 96 pages.

**PB-221 211**

**OIL OF RUE**

Food and Drug Research Laboratories, Inc. September 1972. 13 pages.

**PB-221 212**

**GUM GHATTI**

Batelle Columbus Laboratories. September 1972. 12 pages.

**PB-221 213**

**ZINC SALTS**

Informatics, Inc. September 1972. 109 pages.

**PB-221 214**

## **OIL OF MUSTARD AND ALLYL ISOTHIOCYANATE**

Food and Drug Research Laboratories, Inc. October 1972. 67 pages.

**PB-221 215**

## **GUAR GUM**

Battelle Columbus Laboratories, Inc. October 1972. 40 pages.

**PB-221 216**

## **SULFITING AGENTS**

Franklin Institute Research Laboratories. October 1972. 199 pages.

**PB-221 217**

## **CARAMEL**

John I. Thompson and Co. September 1972. 35 pages.

**PB-221 218**

## **GARLIC**

Food and Drug Research Laboratories, Inc. November 1972. 46 pages.

**PB-221 219**

## **NITRATES AND NITRITES**

Battelle Columbus Laboratories. September 1972. 303 pages.

**PB-221 220**

## **CLOVE AND OIL OF CLOVE**

Food and Drug Research Laboratories, Inc. January 1973. 36 pages.

**PB-221 221**

## **OIL OF NUTMEG AND MYRISTICA OIL**

Food and Drug Research Laboratories, Inc. December 1972. 22 pages.

**PB-221 222**

## **DILL AND DILL OIL**

Food and Drug Research Laboratories, Inc. December 1972. 17 pages.

**PB-221 223**

Food and Nutrition  
(continued)



## **PHOSPHATES**

Franklyn Institute Research Laboratories, Inc. January 1973. 156 pages.

**PB-221 224**

## **AGAR-AGAR**

Informatics, Inc. December 1972. 34 pages.

**PB-221 225**

## **ALGINATES**

Informatics, Inc. December 1972. 71 pages.

**PB-221 226**

## **GLYCERINE AND GLYCERIDES**

Informatics, Inc. February 1973. 220 pages.

**PB-221 227**

## **CELLULOSE AND DERIVATIVES**

Informatics, Inc. December 1972. 90 pages.

**PB-221 228**

## **CAPRYLIC ACID**

Franklyn Institute Research Laboratories. December 1972. 55 pages.

**PB-221 229**

## **GLYCYRRHIZA**

Informatics, Inc. December 1972. 35 pages.

**PB-221 230**

## **CARBONATES**

Informatics, Inc. December 1972. 139 pages.

**PB-221 231**

## **STANNOUS CHLORIDE**

John I. Thompson and Co. February 1972. 54 pages.

**PB-221 232**

## **PROPYLENE GLYCOL AND DERIVATIVES**

Informatics, Inc. January 1973. 64 pages.

**PB-221 233**

## **SULFATES**

Franklyn Institute Research Laboratories. February 1973. 79 pages.

**PB-221 234**

## **AMMONIUM ION**

Informatics, Inc. February 1973. 129 pages.

**PB-221 235**

## **IRON AND IRON SALTS**

Informatics, Inc. March 1973. 101 pages.

**PB-221 236**

## **TOCOPHEROLS**

Informatics, Inc. March 1973. 249 pages.

**PB-221 237**

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## **LOW WATER VOLUME ENZYME DEACTIVATION OF VEGETABLES BEFORE PRESERVATION**

National Canners Association, Research Foundation. J. W. Ralls, and W. A. Mercer. May 1973. 88 pages.

**PB-221 511**

The heating of vegetables prior to terminal preservation by freezing, canning, or dehydration is an essential operation for satisfactory product quality. The primary effect of this blanching operation is to stabilize the food components against rapid chemical changes by thermally inactivating the naturally occurring enzymes. The disadvantages in vegetable blanching using steam or hot water are loss of nutrients and the formation of large volumes of high-strength liquid wastes. These traditional methods of blanching (that is, steam and hot water) have now been compared with two new methods: a microwave method and a hot-gas method. The four systems were examined with respect to operational factors, pollution potential, product quality, and estimated costs; and the results are given in this report. There were no significant flavor differences in vegetables blanched by any of the four methods. The microwave and hot-gas methods were found to produce substantially less waste in comparison to the older methods. However, the capital costs of microwave blanching may be too high for seasonal operation. The hot-gas method appears to be satisfactory in all respects.

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# HIGHWAY ENGINEERING

## CONSTRUCTION, PROTECTION AND MAINTENANCE OF CONCRETE BRIDGE DECKS

Kentucky Department of Highways, Division of Research. R. D. Hughes, and J. H. Havens. August 1972. 305 pages.

**PB-218 434**

Increased attention has been drawn to the premature deterioration of highway bridge decks, and considerable research is in progress. For example, some decks have required maintenance after less than one year of service, others have provided several years of maintenance-free service, whereas still others have needed only nominal repairs. The report gives a historical account of deterioration in reinforced concrete bridge decks, noting cracking, scaling, and spalling as the visible signs. It is observed that some cracking is considered normal, although it may aggravate spalling; a mathematical expression is derived. Scaling appears normal and is considered controllable. Spalling is discussed as the more serious form of distress. Preventive maintenance treatments such as sealants or protective coatings are seen as promising, with case studies of selected decks admixtures cited. Other studies of concrete and mortar overlays are presented. Results are described for latex-modified cement overlays and patches, and for epoxy-sand surfacings and patches. Studies are included of decks having additional reinforcement, replaced decks, and non-treated structures. Reference is made to two projects for providing more durable decks, one using a bilayered method, and the other for developing a voidless concrete.

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## INVESTIGATION OF TRAFFIC INDUCED VIBRATIONS AND THEIR EFFECTS ON THE CONCRETE DECKS OF HIGHWAY BRIDGES

University of Alabama, Department of Civil and Mineral Engineering. John B. Karrh, and Terry R. Douglas. December 1971. 92 pages.

**PB-220 069**

Investigation of the vibrational properties of railroad bridges has been in progress since the phenomenon was recognized 50 years



ago, but only recently has the study of highway bridge vibrations been seriously considered. A conjecture that either forced or free vibrations could have detrimental effects on the physical performance of highway bridges has led to the reported observations. It has been recognized that many bridges of the concrete deck, rolled steel girder type appear to have unusually long free vibration periods. On the premise that these periods could be associated with the nature of the bridge supports and with the substructure characteristics, a program was devised to measure the dynamic behavior of 30 three- and four-span noncomposite steel girder bridges, and to test the vibration effects on three concrete bridge decks, under the loading of a semitrailer truck. Natural frequencies were determined, along with maximum amplitudes, damping constants, and the effects of bearing types, pier heights, footing features, and superstructure features. Each bridge was instrumented in a similar manner, using piezoelectric velocity transducers. Cracking and deteriorations were noted. Correlation was sought between deck deterioration in bridges that are extremely sensitive and the vibrations induced by heavy trucks. Recommendations are made regarding increased use of composite spans.

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### **FACTORS AFFECTING THE DURABILITY OF CONCRETE BRIDGE DECKS: NORMAL VS. THICKENED DECK**

California State Division of Highways. M. W. Horn, C. F. Stewart, and R. L. Boulware. May 1972. 34 pages.

#### **PB-220 113**

The decks of highway bridges are occasionally designed unusually thick to accommodate anticipated heavy earth moving construction equipment. Often such a deck is one of a pair of structures, the other being constructed of normal thickness. These decks offered an excellent opportunity to evaluate the effect of deck thickness on deck cracking. Sixteen pairs of parallel bridges that did not undergo the expected heavy loading were selected and studied for deck surface cracking. Each pair contained a structure with thickened decking and a corresponding structure designed for normal live loads. The results are discussed in detail for each pair. The cracking pattern was observed, and comparison was made using a crack index calculated for each structure. It was found that the thickening slightly reduced total deck cracking, most of the reduction occurring in the larger size cracks. Precise relationships were not obtained because of the presence of other variables that could not be isolated.

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## **GUIDELINES FOR THE DESIGN OF SUBSURFACE DRAINAGE SYSTEMS FOR HIGHWAY STRUCTURAL SECTIONS**

Cedergren and Ken O'Brien & Associates. Harry R. Cedergren, Ken H. O'Brien, and Jorge A. Arman. June 1972. 29 pages.

### **PB-220 116**

Most modern highway pavement structural sections are slow draining systems, and the impact of heavily loaded wheels on sections containing considerable water leads to accelerated damage and deterioration. The guidelines are intended to assist in designing drainage layers to reduce the exposure of roadbeds to excess water. Design criteria and methodology include an inflow-outflow analysis of subsurface systems, open grading of drainage layers, and data on collector drains, pipe outlets and markers. Examples are given for embankment sections, out sections, and superelevated curves. Emphasis is on eliminating water that infiltrates through surface cracks, construction joints and permeable roadway components. The concluding section gives general guidance for design, construction, and operation of subsurface drainage systems.

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## **ULTRASONIC INSPECTION OF BUTT WELDS IN HIGHWAY BRIDGES**

California State Division of Highways. Paul G. Jonas, and Dennis L. Scharosch. October 1972. 69 pages.

### **PB-220 306**

Recent development of ultrasonic examination of butt welds in highway bridges has shown that nondestructive radiographic inspection, formerly considered reliable, has actually been deficient. Ultrasonic detection has disclosed flaws in welded joints that are not apparent on radiographic records; small volume flaws characterizing welding errors, such as fine cracks, are not normally revealed on the radiographs, and borderline or poor control of radiographic film can result in impaired contrast and obscured flaw indications. The objective of the reported study was to determine if ultrasonic inspection could be used to reveal serious full penetration butt weld defects that may develop in the fabrication of structural steel bridge girders. The results are discussed, leading to the conclusion that ultrasonics offer a safe reliable method of inspection. Problem areas such as operator training, repeatability of findings, and interpretation have been investigated both in the laboratory and in service.

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## **AUTOMATED MINIMUM COST DESIGN OF SIMPLE SPAN PRESTRESSED CONCRETE BOX GIRDER BRIDGES**

Highway  
Engineering  
(continued)

University of California (Berkeley), College of Engineering. G. H. Powell, L. V. Ramakrishna, and R. Poole. December 1971. 110 pages.

### **PB-220 326**

The report discusses the structural design of a highway bridge incorporating girders of prestressed concrete and composed of adjoining rectangular cells, or boxes. A 47-foot bridge width and two different span lengths—125 feet and 250 feet—were selected for study. The principal purpose of investigation was to use the computer for the structural design, to develop a greater understanding of the design problem, and to explore one particular method of solution. The logic of design is complex and not well understood. A specific class of solution techniques, nonlinear programming, is discussed for achieving minimum costs. The first step considered is selection of the physical parameters: constant, optimal variable, and dependent variable. The second step in the problem formulation is definition of service conditions, principally the various types of loads to be borne. The third step is definition of adequate performance, both in qualitative terms and with relation to constraints. Cell dimensions and components are discussed.

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## **A THEORETICAL AND EXPERIMENTAL STUDY OF DYNAMIC HIGHWAY LOADING**

University of Texas, Center for Highway Research. Nasser I. Al-Rashid, Clyde E. Lee, and William P. Dawkins. May 1972. 315 pages.

### **PB-220 373**

Dynamic forces applied to a roadway surface by the wheels of moving vehicles are largely responsible for certain types of pavement distress that ultimately lead to failure and unserviceability. A theoretical technique combining mathematical simulation and computer analysis to predict wheel loads is described. Mathematical models of five representative classes of highway vehicles were formulated and verified in field tests, with good agreement between computed and measured wheel forces in a vehicle speed range of 10–60 miles per hour. The simulation models can be used directly for designing pavements and bridges and for researching on improved structural design. Analysis of the experimental data shows that a single pair of dynamic scales installed flush with the pavement surface can estimate accurately the static wheel loads and the gross vehicle weights, with the advantages of safety, convenience, and economy. The models are discussed in detail.

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## CRITERIA FOR THE DESIGN OF AXIALLY LOADED DRILLED SHAFTS

University of Texas, Center for Highway Research. Lymon C. Reese, and Michael W. O'Neill. August 1971. 76 pages.

### **PB-220 838**

Drilled shafts are also known by a variety of other names, including drilled piers, cast in situ piles, bored piles, and drilled caissons. They are made by drilling a hole into the soil and casting concrete in the hole directly against the natural soil. The most predominant use is in foundations for bridges, although drilled shafts have also been used as anchorages and as earth retaining structures. Drilled shafts are foundation alternatives to driven piles, and the reason that this alternative is chosen is often one of economics. Based on the results of a six-year field investigation program and a thorough review of other studies, realistic criteria were established for design values of side resistance and base capacity of drilled shafts. This report provides a step-by-step procedure, incorporating these criteria, for use in designing shafts in predominantly clay soils. The procedure includes the effects of construction technique and shaft geometry and is intended for use in the design office.

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## CAPACITY OF PILE ANCHORS

California Division of Highways. M. W. Horn, C. F. Stewart, and R. L. Boulware. December 1972. 98 pages.

### **PB-220 852**

Experience with piling for highway bridges and other structures has indicated a need for positive anchorage of piles to the substructure to resist uplift forces. The report cites cases where piling might have prevented severe structural damage: where large lateral earth pressures have pushed piling out from under abutment diaphragms, where flood waters have exerted sufficient pressure on a bridge to cause overturning, and where earthquake cyclic forces have caused pile pullouts. To overcome these problems several anchors have been developed for use with both steel and timber piles, based on a capacity arbitrarily set at the same ratio as design for horizontal earthquake forces. Estimated costs of such anchors are noted. Tests to failure are reported on each of six types of pile anchors to determine capacity to resist uplift forces on bridge footings, as well as to find whether the lowest cost anchors were safe to use. The piles were cast in concrete blocks simulating bridge footings and tested using both static and cyclic loads. The results are analyzed, and some recommendations are made.

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## **LATERAL RESISTANCE AND DEFLECTION OF VERTICAL PILES**

California State Division of Highways. W. S. Yee. January 1973. 109 pages.

### **PB-220 889**

Vertical piles in a highway bridge substructure are required to resist lateral forces resulting from post-tensioning of concrete superstructures, seasonal length changes, unbalanced earth loads, and seismic accelerations. Although it is important to predict the behavior of a vertical pile, consideration has not usually been given to the effects of a multilayer system, the boundary conditions at the top on induced deflections, and bending moments on the lateral capacity of a pile. The objective of the reported research was to verify a theoretical design procedure for predicting lateral capacity. A two-layer soil system consisting of a compacted embankment on an underlying natural deposit of silt or clay was studied in field investigations of two bridge embankments. Correlations were made between the theoretical solutions and the field test data. The results indicate that major support for the laterally loaded piles was provided almost entirely by the upper stratum of embankment material. Following discussion of the findings, some recommendations are made.

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## **THE EFFECT OF INTERNAL WELD DEFECTS ON THE FATIGUE BEHAVIOR OF WELDED CONNECTIONS**

University of Illinois, Department of Civil Engineering. David H. Ekstrom, and W. H. Nunse. February 1973. 97 pages.

### **PB-220 896**

A discussion is made of discontinuities in the welded joints and connections of highway bridges. Lack of penetration or fusion, shrinkage cracks, slag inclusions, and porosity, if of sufficient magnitude, will lower the strength of a connection, especially under cyclic loading. The report examines the effects of internal flaws on the fatigue behavior of butt-welded connections in a mild structural steel, the initiation of fatigue cracks from the flaws, and the rate of propagation of these cracks. Test specimens were fabricated by means of welding procedures developed to consistently produce weld flaws, with size and distribution of the flaws controlled from one specimen to the next to prepare the specimens to the quality desired. The defects were intended to simulate those that might exist in actual structures. The study was limited to two major types of flaws: porosity and incomplete penetration. Porosity was subdivided into two severity categories. Three incomplete penetration specimens were examined radiographically during fatigue testing to investigate crack development.

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# INDUSTRIAL PROCESSES

## **FREEZE DRYING**

Defense Documentation Center. July 1973. 58 pages.

### **AD-764 500**

This bibliography is comprised of abstracts of reports of US Government-funded research on freeze drying (lyophilization). Emphasis is on application to biological research and to food technology. The period covered is 1970 through February 1973. (A bibliography covering the period 1953-69 is available as AD-702 700; see AMTID, April 1972, page 78.) All of the reports listed are available from NTIS.

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## **PRINCIPLES OF INCREMENTAL FORGING: PHASE 3**

University of Illinois at Chicago Circle, Department of Materials Engineering. T. F. Restivo, A. H. Lonn, and J. A. Schey. July 1973. 68 pages.

### **AD-764 618**

Conventional forging techniques produce a finished forging by shaping the workpiece in a succession of dies. The cost of the required die set can be particularly high when a relatively small number of forgings is required in any one shape. By means of a technique called incremental forging, nonaxially symmetric parts with cross-sections changing along their length can be formed with tools that deform only a small portion of the workpiece at any one time. Previous work on this technique is described on the Phase 1 and Phase 2 reports, AD-711 303 and AD-720 012, respectively (see AMTID, April 1972, pages 78 and 79). The present report briefly reviews earlier developments, and then discusses and appraises the results of equipment and process development for application of the incremental technique to hot forging. Attention is also given to the selection of suitable lubricants. The feasibility of hot forging complex cross-sectional shapes with a programmed sequence of individual indentations was established.

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## MACHINE SHOP PRACTICE

Industrial Processes  
(continued)

Defense Documentation Center. August 1973. 164 pages.

### AD-765 400

This bibliography contains abstracts of results of US Government-funded studies related to machine shop practice. The reports, which were published during the 1960-72 period, deal with machine shop layout, techniques, procedures, manufacturing methods, and time studies. Material is also included on the performance capabilities and effectiveness of machine cutting, drilling, grinding, reaming, forming, spinning, and shearing operations. Indexes are included. The reports listed in this bibliography are available from NTIS (prices on request).

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## VAPOR PLATING

Defense Documentation Center. August 1973. 200 pages.

### AD-765 475

This bibliography is comprised of abstracts of reports of US Government-funded research and development on vapor plating. The subject matter covered includes metal films, thin films, semi-conducting films, metal coatings, crystal growth, refractory materials, process development, and manufacturing methods using vapor plating techniques. The reports listed were all published during the period 1961 through March 1973. A complete set of indexes is included. All items listed in this bibliography are available from NTIS; prices are available upon request. (This document supersedes a previous edition, AD-704 450; see AMTID, January 1972, page 44.)

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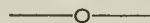
## RECENT DEVELOPMENTS IN ACOUSTIC EMISSION AS APPLIED TO WELDING DEFECTS

University of California (Los Angeles), Materials Department.  
Kanji Ono. September 1973. 22 pages.

### AD-768 396

The detection of flaws in welded structures has always involved a search for improved methods of nondestructive testing. During the past decade a new technique—acoustic emission (AE) testing—has been added to the ranks of the practical methods. Frequency spectra of AE signals from tensile deformation of various alloys and steels have been determined, although special techniques are necessary as these signals are by nature random and close to random noise. The report focuses its attention to signal characteri-

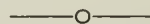
zation, examining the potential analysis methods that may establish signal origins; mechanisms of AE during fracture processes that can form the basis for AE testing of welding defects; and flaw location schemes, examining a representative testing system and its characteristics. Mathematical expressions are noted for crack behavior, and considerable data are presented in graphic form. Successful applications are described, and some indications for further research are made.



## NONDESTRUCTIVE EVALUATION TECHNIQUE GUIDE

Lewis Research Center (NASA). Alex Vary. 1973. 111 pages.  
**N73-31441**

Nondestructive evaluation (NDE) is a branch of materials science that is concerned with all aspects of the uniformity, quality, and serviceability of materials and structures. By definition, NDE techniques are the means by which materials and structures may be interrogated without disruption or impairment of their serviceability. Internal properties or hidden flaws are thus revealed or inferred by appropriate techniques. NDE is becoming an increasingly vital factor in the effective conduct of research, development, and manufacturing programs. This document is intended to serve as a guidebook for the application of NDE techniques. The objective is to provide a survey of currently available techniques, particularly for those who are unfamiliar with the wide range covered by NDE. A total of 70 individual NDE techniques are described, each in a standardized format for quick reference. Information is presented in a manner that permits ease of comparison of the merits and limitations of each technique with respect to various NDE problems. A cross-indexing system is used that refers the user to appropriate NDE techniques when the attribute, property, or flaw to be tested for is known. A bibliography of basic reference sources is included.



# MARINE ENGINEERING

## COMPARISON STUDY OF ALUMINUM, FERRO-CEMENT, AND FIBER-REINFORCED PLASTIC FOR SMALL CRAFT IN KOREA

Naval Ship Research and Development Center. Benjamin Whang. December 1972. 36 pages.

AD-755 424

This document is concerned with the tradeoffs between ferrocement (mesh-reinforced cement), aluminum, and fiber-reinforced plastic as materials for the construction of small craft hulls. It was originally prepared for the Korean Navy, but much of the information should be of interest elsewhere. A comparison is made of the three materials in terms of construction costs, strength-stiffness/weight characteristics, maintenance, fatigue, impact, fire resistance, etc., within the framework of Korean technology and economics. Each material is first described separately, the three are compared, and recommendations are made for the selection of a hull material. A bibliography of relevant publications is included.

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## FEASIBILITY STUDY OF HYDROCYCLONE SYSTEMS FOR DREDGE OPERATIONS

Oklahoma State University. W. G. Tiederman, and M. M. Reischman. July 1973. 184 pages.

AD-766 212

A major difficulty with dredge spoil is discussed. In most dredging operations quantities of small suspended solids become dispersed in the large volumes of water used to clear the waterway bottom. It may be inefficient to transport the entire volume of water to a disposal site, undesirable to return the turbid water to the waterway, or possible to suffer overflow at the disposal site. Consequently processes are needed to clarify the water and concentrate the small suspended solids, thereby decreasing the environmental impact of dredge operations. The purpose of the study was to investigate the use of hydrocyclone separators to improve dredge spoil operations. The hydrocyclone is an inertial separator in which solids heavier than water are removed by centrifugal force.



Contaminated water enters a spinning conical device which by swirling flow ejects concentrated solids at the narrower lower end and lighter ones at the broader upper end. The feasibility study used six samples of dredged materials in a laboratory investigation. The method would appear to be promising mainly for recovering sand or large particles for use in landfills or as construction materials.

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## PROCEEDINGS OF THE FIFTH DREDGING SEMINAR

Texas A&M University. June 1973. 102 pages.

### COM-73-11293

A 1972 seminar held in Houston, TX, was devoted to dredging—operations, equipment, problems, and impact. There were eight presentations: (a) Dredge hulls—construction and reconstruction. Basic requirements were outlined, such as stability, strength, and stiffness; ideal design and observed failures were described. (b) Economic justification for the use of a fully lined dredge pump. Maintenance downtime reduction, longer wear life, and lower replacements costs were cited. (c) The offshore dredge—a solution to beach restoration. (d) Soil mechanics applied to dredging. Need was noted for technical knowledge of soils. (e) Bartow maintenance dredging and water quality. A specific project to correct channel siltation was analyzed. (f) Corps of Engineers dredging operations in Galveston. (g) Present status of soil disposal areas along the Houston ship channel. A progress report and indications for future operations were made. (h) Offshore dredging problems. A prediction was made for the dredging market, with special reference to supertanker harbors and beach nourishment.

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## APPLICATION OF WATERJET HYDRAULICS TO AN UNDERWATER EXCAVATION SYSTEM

Oregon State University. L. E. Johnson. 1973. 14 pages.

### COM-73-11519

Fishing gear, oceanographic instruments, or other equipment may be intentionally left on the ocean floor for later recovery. This gear may become so covered with sediment that identification and retrieval may be difficult or impossible. One method employed by large crabbing boats to extricate crab pots stuck in the sea bottom is to blow the sediment away by means of a water jet from a fire hose attached to a sea water pump. The report describes a laboratory development of this improvisation. Tests were performed in a tank with single water jets to determine jet velocity and nozzle diameter for gaining best performance. A four-nozzle configuration was arrived at that produced favorable results. In

the case of smaller boats without adequate on-board pumping capacity, a portable pump-nozzle package was sought for sharing by several boats to recover buried gear. A description is given of an assembly that appears promising, to be tested by fishermen. Indications of good performance and acceptance have been obtained.

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Marine Engineering  
(continued)

### **COASTAL ZONE BIBLIOGRAPHY: CITATIONS TO DOCUMENTS ON PLANNING, RESOURCES MANAGEMENT, AND IMPACT ASSESSMENT**

California University, Jens Sorensen, and Marie Demers. August 1973. 97 pages.

#### **COM-73-11567**

This bibliography on coastal zone management was compiled to aid in assessment of the environmental and socioeconomic impacts of coast development and resource use. A subject index is included. A few of the topics are access, air pollution, benthos, bridges, channels, commerce, drainage, ecology, economic aspects, endangered species, environmental impact, erosion, esthetics, estuaries, geology, highways, hydrodynamics, hydrology, land use, legal aspects, marine organisms (plant and animal), modeling, monitoring, ocean dumping, oil pollution, owners' rights, pesticides, planning (regional and urban), policies, ports, public attitudes, recreation, regulations, residential development, resources, sediment, sewage, shoreline protection, solid wastes, technologies, thermal pollution, tourism, toxic substances, transportation, visual quality, water pollution, watersheds, wetlands, and wildlife refuges.

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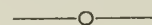
# MATERIALS

## PROOF TESTING OF CERAMIC MATERIALS. AN ANALYTICAL BASIS FOR FAILURE PREDICTION

National Bureau of Standards, Institute for Materials Research. A. C. Evans, and S. M. Wiederhorn. March 1973. 35 pages.

### AD-759 373

In many ceramic systems of structural importance, slow crack growth precedes fast fracture, leading to a time dependence of strength. Successful structural engineering with these materials therefore requires a detailed understanding of time dependent behavior so that accurate failure predictions can be made. The life expectancy of a ceramic involves two fracture processes, flaw initiation and flaw propagation. One of these is usually predominant although both may sometimes contribute to the failure. The report presents a mathematical analysis of crack growth kinetics, providing a prediction of time to failure under constant load. Also analytical predictions are developed of time to failure after proof testing, involving a normal amount of slow crack growth which is expected to occur during the proof test. A discussion is made of analysis which permits the accurate prediction of lifetimes after such proof testing. The analysis applies to crack propagation controlled fracture but can be used as a conservative prediction when crack initiation is predominant. The analysis is confirmed by failure measurements, also referred to.

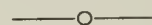


## CHARACTERIZATION OF COMPOSITES FOR THE PURPOSE OF RELIABILITY EVALUATION

Air Force Materials Laboratory. J. C. Halpin, K. L. Jerina, and T. A. Johnson. December 1972. 100 pages.

### AD-764 356

A design philosophy for composite materials, that is based on prevention of failure via reliability, is described. The reliability of a structure depends on a description of the material system and the attendant uncertainties in this description, along with a description of the structural complexity, expected structural loads, and expected operating environment and their attendant uncertainties. Several models for composite behavior are developed and discussed. Consideration is also given to the engineering consequences of statistics, and to the achievement of reliability through proof-testing.





## **DIRECTIONALLY SOLIDIFIED COMPOSITES**

National Research Council, National Materials Advisory Board.  
April 1973. 122 pages.

### **AD-765 348**

Early in the 1960's a new class of engineering material was conceived—eutectic alloys that can be manufactured to possess unusual, highly anisotropic microstructures and properties. These materials have come to be variously called directionally solidified composites, in situ composites, and directionally solidified eutectics. This report focuses on the potential of this new material, the problems faced in designing equipment, using it, and the steps that should be taken to advance the science and technology of directionally solidified composites. Consideration is given to alloy development, influence of geometry, characterization data and stability, materials design information, oxidation and coatings, joining, design and testing of gas turbine components, processing of parts, nondestructive inspection, and nonstructural applications of directionally solidified composites.

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## **FUSED SILICA DESIGN MANUAL, VOL. 1**

Georgia Institute of Technology, Engineering Experiment Station.  
J. N. Harris, and Earle A. Welsh. May 1973. 151 pages.

### **AD-766 494**

Fused silica is an amorphous (noncrystalline) form of silica and is usually prepared by flame or arc fusion of quartz sand. Probably the most attractive property of fused silica is its high resistance to thermal shock. Because of this property, it has long been used in applications where articles are subject to rapid changes in temperature, such as high intensity lamps and laboratory ware. It is also used where high dimensional stability is required, such as in precision optical equipment. The main reason that the use of fused silica has not been more widespread is the difficulty of working it. In recent years, however, a slip casting technique has been developed that permits forming larger and more intricate shapes than had previously been practical. This manual provides a summary of the current state of knowledge of designing slip-cast fused silica shapes. It is intended to furnish a basic review of the material and its processing techniques, as well as basic design information. The topics covered include fused silica raw material preparation, size reduction, slip preparation, slip casting, drying, firing, and properties at ambient and elevated temperatures. Vol. 1 is self-contained and may be used independently of Vol. 2, which is not currently available.

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**Materials**  
(continued)

## **EFFECT OF IONIZING RADIATION ON PHYSICAL AND CHEMICAL PROPERTIES OF FIBERBOARD AND PAPERBOARD**

U.S. Army Natick Laboratories, General Equipment and Packaging Laboratory. John K. Killoran, Sheo Ram Agarjal, and Peter T. Burke. October 1972. 30 pages.

### **AD-767 250**

During the irradiation sterilization (radappertization) processing of foods, it may be desirable to perform the actual irradiation after the packaged food is placed in shipping containers. This report gives the results of a study that was designed to determine the effect of gamma and of electron radiation on the chemical and physical properties of fiberboard and paperboard container materials. The study also evaluated the performance of shipping containers during the irradiation processing and subsequent shipment and storage. The amount of damage that can be expected at various combination of radiation dosage and irradiation temperature is shown. Under most normal irradiation processing conditions, the strength loss of the containers was found not to seriously impair their functional performance.

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## **RESIN EFFICIENCY AND DIMENSIONAL STABILITY OF FLAKEBOARDS**

U.S. Department of Agriculture, Forest Products Laboratory. W. F. Lehmann, and V. F. Hefty. 1973. 9 pages.

### **AD-767 573**

Resin efficiency, or the attainment of desired mechanical and physical properties with a minimum amount of resin binder, is considered of prime importance in producing particleboard. Resin costs remain one of the major manufacturing expenses, thereby calling for knowledge of resin amount and application effects to produce adequate boards economically. Dimensional stability was studied in particleboards prepared from a wood flake particle mixture. Three levels of resin content, two levels of resin atomization, and two board densities were used to study the effects of relative humidity and water-soak exposures. The effects of all these are reported.

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## **FACTORS AFFECTING PARTICLEBOARD PRESSING TIME: INTERACTION WITH CATALYST SYSTEMS**

U.S. Department of Agriculture, Forest Products Laboratory. W. F. Lehmann, R. L. Geimer, and F. V. Hefty. 1973. 21 pages.

### **AD-767 574**



The use of particleboard in construction has received increasing attention in recent years, as a means both of producing materials superior for certain uses to natural wood and of using otherwise wasted materials. The report is one of a continuing series concerning the individual effects of variables on minimum pressing time for particleboards. (The previous work is described in AD-750 010; see AMTID, July 1973, page 36.) Following evaluations of uncatalyzed resin binders at uniform and nonuniform mat moistures previously reported, the study deals with catalyzed systems. The intent was to investigate several types, levels, and combinations of catalysts used in gluing both interior and exterior type particleboards, and to determine their effects in combination with other variables on the reduction of press time. Catalysts investigated are urea-resin, standard and fast-curing phenolic resins, potassium chromate, and methylethyl ketone hydroperoxide. The effects of species, physical properties, and temperature are noted for 1/2 inch thick panels.

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## **HANDBOOK OF OCEANOGRAPHIC ENGINEERING MATERIALS. VOL. 1. METALS AND ALLOYS**

Woods Hole Oceanographic Institution. Stephen C. Dexter. December 1972. 102 pages.

### **COM-73-10660**

This handbook is intended to serve as an aid in materials selection for oceanographic engineers and designers. As such it is limited to materials that may be used advantageously in marine environments. The data presented should be of assistance in optimizing materials selection with regard to mechanical, physical, and chemical properties; corrosion resistance; fabricability; availability; and cost for sea water applications. Aluminum alloys, copper alloys, nickel alloys, iron, steel, stainless steel, titanium, magnesium, and zinc are the materials treated in this volume. A projected second volume covering nonmetallic materials is not currently available.

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## **STATUS AND PROSPECTS FOR FLAME RESISTANT POLYESTER/CELLULOSE BLEND FABRICS**

National Bureau of Standards, Fire Technology Division. Giuliana C. Tesoro. March 1973. 56 pages.

### **COM-73-11265**

The development of polyester/cellulose, primarily polyester/cotton, blend fabrics and their rapid growth in textile markets have taken place largely during the 1960's. However, the manufacture of fabrics which can maintain their desirable aesthetic and performance qualities, exhibit self-extinguishing behavior in flammability tests, and be produced at reasonable cost, is a complex and



largely unresolved problem. This document provides a survey of the current status and future prospects of the problem. Consideration is given to the availability of materials (fibers and chemical finishes); development activities in industry; possible flame resistant polyester/cellulose blend products based on known technology (finishing currently available polyester/cellulose fabrics; finishing of fabrics made from cotton and fire resistant polyester; fabrics made from fire resistant rayon and fire resistant polyester; and development and research needs in fibers, chemical finishes, fabric processing technology, new approaches, evaluation and test methods, and the effects of laundering conditions.

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### **WATER-FILLABLE POLYMERS—ABLATIVE MATERIALS FOR FIRE RESISTANCE**

University of California (Berkeley), Structural Engineering Laboratory. James Phil Davidson, and Robert Brady Williamson. September 1971. 52 pages.

#### **PB-216 328**

Several polyester casting resins are commercially available that use water to extend the polyester to reduce cost and improve physical properties. This document considers the potential of these water-fillable polymers in fire resistance applications. The excellent performance of these materials in fire tests conducted on small wall panels is described. These results indicate that water-fillable polymers would be very desirable materials for incorporation as fire barriers into building components or any system that requires specified thermal endurance. An explanation of that water-fillable polymers work as fire barriers is provided.

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### **WORLD COTTONS**

University of Texas, Cotton Research Committee. August 1969. 117 pages.

#### **PB-219 091**

The cotton industry has reached the stage where cotton production is a world system. This document is aimed at enabling producers, shippers, and millers to understand the world cotton picture better in order to forecast trade. Data are given for the period 1934-38 and the 1958-59 season as presented in an earlier study, with data for 1968-69 for comparison. Chapter headings are on the cottons of North America, South America, Europe, the USSR, Asia and Oceania, and Africa. Tabulations are then given for world production, with some analysis and expectations for the future.

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## **MATERIAL REQUIREMENTS IN THE UNITED STATES AND ABROAD IN THE YEAR 2000**

**Materials**  
(continued)

University of Pennsylvania, Wharton School. Wilfred Malenbaum, Carol Cichowski, Fathollah Mirzabagheri, and James Riordan. March 1973. 44 pages.

### **PB-219 675**

The continuous process of economic and social change has resulted in the use of raw materials in ever-growing quantity and in ever-diversifying variety. The result has been an accentuated rate of resource exhaustion and environmental deterioration. The wealthier nations voice concern over environmental deterioration and their growing dependence on less developed lands to meet their own requirements. Poor lands are concerned about growing competition for materials just as their own needs in industrialization gain momentum—and that they may have to bear the bulk of the “limits to growth.” The main body of this document provides estimates of materials required in the year 2000 by the nations of the world other than the United States. The gross domestic product for each of nine world regions is projected to the year 2000. On the basis of these projections and other considerations, requirements for crude steel, iron ore, refined copper, primary aluminum, zinc, fluorspar, sulfur, and energy fuels are projected to the same time period. An annex to the report presents comparable estimates for the United States.

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## **UTILIZATION OF BARK WASTE**

Oregon State University, Department of Forest Products. R. A. Currier, and M. L. Laver. July 1973. 184 pages.

### **PB-221 876**

Bark wastes generated by forest products industries create a disposal problem, but they also represent a potential resource. This report gives the results of work which utilized the physical and chemical sciences to promote economic uses of bark. In one phase of the study it was found that bark may be pelletized. Pelletizing bark increases its bulk density and handling characteristics for easier transportation. One of the most promising applications of pelletized bark is as a carrier for fertilizers and other chemicals used in agriculture. It may also be used as a fuel. During a second phase of the study it was found that some barks would undergo “self bonding” so that molded articles could be produced without the use of bonding agents. Bark can also be used as an additive to plastics. Chemical studies revealed that bark treated with gaseous ammonia will yield a product that is useful for soil amendment. This product possesses a quick release nitrogen supply followed by a slow release nitrogen supply as the bark decomposes.

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# MECHANICAL ENGINEERING

## COMPOSITE-OVERLAY REINFORCEMENT OF CUTOUTS AND CRACKS IN METAL SHEET

National Bureau of Standards, Engineering Mechanics Section.  
Richard A. Mitchell, Ruth M. Woolley, and Daniel J. Chwirut.  
February 1973. 97 pages.

### COM-73-11221

An overlay of high-strength, high-stiffness composite material offers an efficient means of achieving local reinforcement of cutouts and cracks in metal sheet. This concept can be used in the design of new structures or it can be used to strengthen existing structures. Finite element computer programs have now been developed to analyze such reinforcements. The programs are also suitable for the analysis of adhesively bonded lap joints. The outputs of the program are in a form that permits visualization of the interactions of the different elements of the total system. They also indicate the presence of stress conditions that might initiate or drive a crack or a debond. Special features of reinforced systems, such as cushions, tapers, and debonded regions can be explicitly studied.

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## SHEAR CONNECTOR STUDIES ON CURVED GIRDERS

University of Maryland, Civil Engineering Department. James Colville. February 1972. 86 pages.

### PB-220 117

Materials are presented on designing mechanical shear connectors in curved composite girder sections. Each section consists of a curved steel beam interconnected with a cast-in-place reinforced concrete slab acting as a single unit in resisting external loads. The function of the shear connectors is to transfer forces across the surface between the concrete slab and the steel beam. The report discusses theory; an experimental program involving radius of curvature, loading and support, testing and instrumentation; concrete properties and data reduction; and design equations. A connector failure criterion is included. Design procedure is applicable to single span girders only, and a trial and error approach is used. Although the design equations are intended for bridge structures, other applications are possible.

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# **MINING AND MINERALS INDUSTRIES**

## **EVALUATION OF ANEMOMETERS FOR USE IN COAL MINES**

Walden Research Corporation. J. F. McCoy. June 1972. 67 pages.

**PB-211 412**

Measurement of air flow in a passageway is important in mining engineering, but the instrumentation presents special problems. The ideal device should be portable, self contained, insensitive to dust and moisture and temperature changes, and safe for use in gassy mines. In addition it should be maintenance free for at least 24 hours, able to cover an air speed range of 20 to 2000 feet per minute, and compatible with recording. An extensive test program is reported on anemometry instruments and concepts, giving an evaluation of rotating vane, restrained vane, turbine, sphere, hot wire, hot film, thermocouple, thermistor, sonic, and ion anemometers, deflecting vane velometers, fluidic flow sensors, and laser velocimeters, capacitance and variable reluctance manometers, pressure sensitive transistors, and potentiometric transducers. Methods to deduce total flow were evaluated by velocity traversing, total flow structures, and gas dilution. The central concept was to design a prototype instrument based on existing components which represent the most advanced state of the art. A literature search was followed by wind tunnel tests. The report describes the various instruments and their characteristic responses, and discusses the advantages of hot film anemometry which was chosen as the most promising method.

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## **ROCK MECHANICS INSTRUMENTATION FOR MINE DESIGN**

Bureau of Mines, Technology Transfer Group. 1973. 79 pages.

**PB-218 565**

This document is comprised of the proceedings of a seminar concerned with progress in certain mine structural design methods, and the description of some new instrumentation developed for rock mechanics investigations in coal and metal mines. Major presentations covered theory of mine design, solution of mine structure problems through field measurements and theoretical analysis, a borehole deformation gage for determining in situ stress, use of a hydraulic pressure cell to determine the modulus of rigidity of rock along with a borehole pressure cell to detect changes of rock

pressure, a borehole device to determine in situ elastic constants of coal, and field operation of an automatic recording borehole inclinometer probe.

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## **MANGANESE NODULE DEPOSITS IN THE PACIFIC. SYMPOSIUM/WORKSHOP PROCEEDINGS**

State of Hawaii, Center for Science Policy and Technology Assessment. Ginger Plasch (Ed.). February 1972. 220 pages.

### **PB-218 948**

These proceedings are comprised of the papers presented at a forum convened to discuss the latest developments and the present status of the exploration and use of manganese nodule resources in the Pacific. The topics covered include: International law applicable to deep sea mining; worldwide distribution and metal content of deep-sea manganese deposits; spectroscopic analysis of manganese nodules; Indian/Antarctic nodules; potential economic value of ocean-floor manganese nodule deposits; land-base requirements for deep-ocean manganese nodule mining; environmental impact of manganese nodule mining; consequences of alternative resource allocation plans for ocean mining.

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## **SHAFT DRILLING: STATE OF THE ART**

James H. Cobbs Engineering. James H. Cobbs, and Louis R. Reeder. March 1973. 170 pages.

### **PB-220 368**

The report discusses technology, equipment, advantages, and problems for two methods of drilling large diameter mine shafts, with particular reference to coal mines. The first is blind drilling, in which the hole is bored downward from the collar to the terminus without access to the target. Drilling may proceed in one or several steps, but underground access is not established until after completion of the hole. The second, most widely used at present, is one in which a pilot hole is first drilled to the target area, after which upward reaming is performed with cuttings falling to the bottom of the hole by gravity. Bored shafts up to 25 feet in diameter are covered. Included are descriptions of site selection and preparation, drilling equipment and operations, grouting methods, hole lining techniques, and problems unique to shaft boring in coal provinces. Materials are presented on novel drilling methods, a tabulation is given of mine shafts drilled to date, and the treatment of hazards is discussed.

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**SUBSIDENCE DUE TO UNDERGROUND MINING**  
**1. THEORY AND PRACTICES IN PREDICTING**  
**SURFACE DEFORMATION**

Mining and Minerals  
Industries  
(continued)

Bureau of Mines, Denver Mining Research Center. Gerhard Brauner. March 1973. 62 pages.

**PB-220 495**

**SUBSIDENCE DUE TO UNDERGROUND MINING**  
**2. GROUND MOVEMENTS AND MINING DAMAGE**

Bureau of Mines, Denver Mining Research Center. Gerhard Brauner. April 1973. 59 pages.

**PB-220 496**

Surface movements due to mining are a major problem, especially when stratified deposits are completely extracted. Mining thick seams or groups of seams under soft rock sometimes induces intense cracking or caving, whereas mining virgin areas under hard rock or in steep measures at greater depths may cause no appreciable movements at all. The normal case, however, is one in which a relatively continuous surface deformation takes place that is definitely measurable as displacements of surface points. Part 1 of this report gives a review of methods of predicting mine subsidence. The methods are subdivided into two groups, based on mathematical expressions either for the through profile or for the influence of infinitesimal extraction elements. A brief review of experimental and theoretical model investigations is included. Part 2 deals with the practical implications of ground movements concerning surface structures and shafts. Particular attention is given to precautions that can be taken to reduce or prevent damage.

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**MINERALS YEARBOOK. VOL. 3, AREA REPORTS:**  
**INTERNATIONAL 1970**

Bureau of Mines, Mineral Supply Division. June 1973. 1030 pages.

**PB-221 061**

This volume presents the available mineral statistics for more than 130 countries (not including the US) and discusses the importance of minerals to the economies of these nations. For each country, a general summary of the mineral economy is followed by data on mineral production, data on exports and imports of minerals, and individual reviews of the important metallic, nonmetallic, and fuel minerals produced in the country. A separate section provides a discussion of the world's mineral economy.

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## **PREDICTING PROBABLE ROOF FALL AREAS IN ADVANCE OF MINING BY GEOLOGICAL ANALYSIS**

Bureau of Mines, Morgantown Energy Research Center. W. K. Overbey, Jr., C. A. Komar, and J. Pasinni, Ill. May 1973. 19 pages.

### **PB-221 626**

Roof fall studies in coal mines have established that a significant number of these occurrences are attributable to certain geologic features and conditions. Cited contributing factors are bedding planes and joints, planes of weakness, faults, and discontinuities, fracture systems underlying stream channels, ground water seepage through fracture zones, gas and water pressure in strata overlying shale in the mine roof, voids caused by oxidation of pyritic veins, clays in the floor and roof layers, fossils imbedded in roof rock, and rock stresses. The investigative approach reported was to map surface geological features and subsurface geologic structures in areas where mining has been completed and some roof falls have been documented. The objective was to determine the feasibility of predicting probable area for roof falls ahead of mining operations. Aerial photos are seen as reliable indicators of such areas. The procedures employed and the results obtained are described.

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## **A CASE STUDY OF IN-SITU ROCK DEFORMATION BEHAVIOR FOR THE DESIGN OF GROUND SUPPORT SYSTEM**

University of Idaho, Bureau of Mining Research. Samuel S. M. Chan. January 1972. 136 pages.

### **PB-221 880**

The objective of the project was to collect information applicable to ground support systems in deep mines, and to integrate and evaluate the data using a finite-elements computer code. A mine in Idaho was selected as the test site. Conventional underground geological mapping was used to record major rock structures and types. Closure measurement using anchored points and a simple mechanical extensometer was the means for determining in-situ deformation of the rock masses about the drift chosen. Ground stresses were determined by means of a three-component bore-hole deformation gage. The in-situ modulus of deformation was obtained with a unidirectional, hydraulic bore-hole jack. The finite element work was based mainly on a two-dimensional plane strain elastic computer program. The method is described as proving to be satisfactory, although some estimation and personal adjustment will still be required.

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# PAVEMENTS AND PAVING MATERIALS

## STABILIZATION FOR PAVEMENTS

Construction Engineering Research Lab. J. L. Rice. May 1973. 39 pages.

**AD-763 912**

Various forms of soil stabilization to improve subgrade workability for highway construction have been in use for at least 25 years, at times during inclement weather to maintain construction operations, some times during favorable weather to provide support for heavy equipment. It has been noted that the performance of pavements with a stabilized element is superior to performance of identical pavements without stabilization. The designer is of course desirous of cost reduction by means of less expensive subbases or reduction of paving material quantities, but little quantitative information is available for assessing the structural benefits associated with stabilization. The document reports on an extensive testing program which is under way to determine such benefits and utilize them. Rigid and flexible pavement model tests were conducted to evaluate the qualities imparted by lime, bituminous, and cement layers. A discussion is given of the Westergaard algorithm for lime and bituminous stabilized layers, and an elastic layered algorithm for cement stabilized layers, with the California bearing ratio appearing satisfactory for flexible pavements with stabilized elements.

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## NONDESTRUCTIVE TESTING OF PAVEMENTS: FINAL TEST RESULTS AND EVALUATION PROCEDURE

U.S. Army Engineers Waterways Experiment Station. J. W. Hall, Jr. June 1973. 82 pages.

**AD-764 787**

A report is made on an investigation to develop a technique for determining the load carrying capacity of an airfield pavement, conducted in three phases: Determination of the principles and techniques of nondestructive pavement evaluation; development of equipment for such evaluation of rigid and flexible pavements; and refinements to the equipment and testing techniques arrived at. Steady state vibratory load-deflection measurements were made with a counterrotating-mass vibrator. Two evaluation approaches,



deflection-extrapolation and stiffness measurement, are discussed. The circular steel plate equipment is described, along with the electronic controls and recording devices. The results, some conclusions, and some recommendations are presented.

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### **TECHNOLOGICAL FORECASTING: A CASE STUDY OF LONG-TERM REQUIREMENTS FOR RIGID AIRFIELD PAVEMENT SYSTEMS**

Construction Engineering Research Laboratory. William J. Pananos. August 1973. 54 pages.

#### **AD-767 530**

An investigation has been undertaken of the feasibility of using technological forecasting in the development of rigid airfield pavement systems. The entire range of technologies is involved: planning, design, construction, operation, and maintenance. The "Delphi Method" used for the forecasting is discussed as a formal procedure of polling experts in successive questionnaires to reach a consensus opinion. The questionnaires are described, with statistical analysis of the returns from experts in the planning-to-operation features of airfields. The results are presented as a demonstration of how a wide range of information obtainable from expert opinion can conveniently be made available to planners. Particularly notable is the indication that more than one round of questioning is not required to obtain the subjective type of data needed.

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### **PRACTICAL METHOD OF CONDUCTING THE INDIRECT TENSILE TEST**

University of Texas at Austin, Center for Highway Research. James N. Anagnos, and Thomas W. Kennedy. August 1972. 54 pages.

#### **PB-216 991**

A need exists for a simple test method that can be used to evaluate the tensile properties of all types of pavement materials and to obtain information that can be used in pavement design. In partial fulfillment of this need, a practical method has been developed for conducting the indirect tensile test to determine the tensile properties of stabilized pavement subbase materials. This document provides a detailed description of the test, test equipment and procedures, and methods of calculating tensile strength, Poisson's ratio, modulus of elasticity, and tensile strains. The tensile properties obtained from the test are expressed in terms of standard engineering units, which should be an aid in design procedures requiring the elastic constants of the materials involved. Also, since the test is very simple to conduct and uses cylindrical specimens which are easily prepared, it can be used to control quality of construction materials.

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## **A DEFLECTION SURVEY TECHNIQUE FOR PAVEMENT EVALUATION IN DEVELOPING COUNTRIES**

Transport and Road Research Laboratory (Great Britain), Overseas Unit. H. R. Smith. 1973. 40 pages.

### **PB-218 338**

Many of the countries of the world are experiencing a rapid growth of road traffic, both in terms of the weights of vehicles and their numbers. As a consequence there is a need to strengthen and improve a large number of existing roads. The most common way of strengthening a road is to overlay the existing pavement with bituminous premix. Traditionally, the thickness of bituminous strengthening overlays has been decided intuitively or by applying empirical pavement design procedures in which the existing layers are assigned notional structural values. These methods are prone to produce uneconomic designs primarily because they do not take proper account of the residual strength of the existing pavement. In response to this, fieldwork has been undertaken in Malaysia and Zambia aimed at developing a satisfactory deflection survey procedure (using hand-held deflection beams) for evaluating the strength of existing roads. As a result of this work, a survey procedure is recommended in this document and a simple method of analyzing deflection survey data for the purpose of designing strengthened roads is outlined. It is suggested that this approach is especially appropriate for evaluating pavements in areas where the operation of electronic equipment for road testing is difficult and expensive.

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## **RUBBER-ASPHALT BINDER FOR SEAL COAT CONSTRUCTION**

Federal Highway Administration, Implementation Division. Robert E. Olsen. February 1973. 32 pages.

### **PB-219 012**

The development and use of a new rubber-asphalt binder for seal coat asphalt pavement construction is described. Whereas rubber has been added to asphalt in low percentages (3-5%) in the past, this binder uses high percentage (25-30%) additions of granulated rubber, that may be reclaimed from discarded automobile tires or obtained from other sources. The granulated rubber is mixed with hot asphalt to form a tough and elastic binder with less susceptibility to temperature changes. It has been especially successful in overlaying pavements that exhibit severe fatigue or alligator cracking. A construction procedure that has proven practical is described, and a recommended specification for seal coat construction using the rubber-asphalt composition as the binder is given.

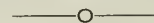
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## REFLECTION CRACKING OF BITUMINOUS OVERLAYS ON RIGID PAVEMENTS

New York State Department of Transportation. Frank F. McCullagh. February 1973. 28 pages.

### PB-219 122

The riding quality of concrete pavements often declines long before serious structural deterioration is apparent. Serviceability is prolonged by overlaying the concrete with an asphalt, but subsurface degeneration still occurs. Vertical movement produced by heavily loaded vehicles depressing abutting slab ends, and horizontal expansions and contractions resulting from temperature changes cause cracking at the transverse joints. Water and foreign matter can then enter, leading to raveling and eventual dislocation and removal of the overlay by traffic. When sealing of these reflection cracks as a remedy are proved to be time-consuming and relatively ineffective, measures were studied to reduce the stresses in the concrete-to-overlay bonding. The report covers four areas of investigation: (a) Broken pavement, in which one pavement section was broken into fragments prior to being overlaid. (b) Stone-dust bond-breakers, in which another pavement section received an application of three different widths of bond-breaking materials. (c) Survey of 86 overlaid concrete pavements in New York state to obtain more insight into reflection cracking. (d) Overlay studies, in which three pavements were observed before, during, and after overlaying to compile more data on the reflection cracking process.



## TECHNIQUES FOR MEASURING AIR VOID CHARACTERISTICS OF CONCRETE

New York State Department of Transportation. Duane E. Amsler, Albert J. Eucker, and William P. Chamberlin. January 1973. 41 pages.

### PB-219 621

A significant development in concrete technology has been the discovery that concrete durability is improved by the intentional entrainment of small amounts of air. It appears that large numbers of extremely small voids relieve disruptive hydraulic pressure at low temperatures and that the spacing of these voids is an essential factor. The report describes the construction and application of various equipment to measure air void system parameters of hardened concrete, using samples from test roads, laboratory mixtures, and early pavements. The data indicated that blends of portland cement and natural cements produced with levels of air content and spacing factors generally superior to those of plain portland cement without air entrainment. There is evidence, however, that the durability observed was not solely attributable to the air void system. Two pieces of equipment were developed, a linear tra-



verse and a high-pressure air meter. Operating characteristics of both are defined, and indications are made for further developments.

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### **SELECTION OF OPTIMUM BINDER CONTENT FOR BITUMINOUS TREATED BASES**

California State Divisions of Highways. T. Scrimsher, G. W. Mann, G. B. Sherman, and M. Johnson. January 1973. 32 pages.

#### **PB-220 086**

The possibility of upgrading local and in-place highway materials by means of bituminous treatment has long been a topic of serious consideration. A depletion of high quality aggregates and increasing local restriction of the development of new aggregate sources has led to increased interest in the use of treated in-place or borrow type materials. Some unprocessed materials can benefit by bituminous treatment more than others; sand, for example, appeared the most promising of four different materials tested in a laboratory investigation. The report discusses the work done in determining binder content and resistance to water action. A literature search disclosed a general lack of definition regarding the use of asphalt treated bases, but the present discussion considers such bases as treated either by road-mixing or plant-mixing with a cationic emulsion or with liquid asphalt. The four material sources used were silty sand, sandy silt, river sand, and decomposed granite. Methodologies, problems, and results are discussed, and some recommendations on structural thickness design are made.

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### **A COMPREHENSIVE STRUCTURAL DESIGN FOR STABILIZED PAVEMENT LAYERS**

University of Texas (Austin), Center for Highway Research. William O. Hadley, W. Ronald Hudson, and Thomas W. Kennedy. August 1972. 200 pages.

#### **PB-220 289**

The report presents a system for preventing tensile failures in the surface and subbase layers of three-layer pavement structure, applicable to highway materials that have cohesion or tensile strength. The thickness requirements provided by this system of structural design are not intended to supersede established requirements, such as those relating to frost penetration. A practical interpretation of layered theory is involved, emphasizing the contribution of each layer to the behavior of the total pavement structure. Design equations are discussed for tensile stress and strain in the surface layer and subbase layer, and compressive strain in the subgrade layer. Separate equations are presented for the design of high modulus portland cement concrete rigid pavements, and procedures for proper application of these equations are given. The favorable



results of using the indirect tensile test are noted. Application of the total design system is illustrated in three example problems.

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### **PREDICTION OF LOW-TEMPERATURE AND THERMAL-FATIGUE CRACKING IN FLEXIBLE PAVEMENTS**

University of Texas, Center for Highway Research. Mohamed Y. Shahin, and B. Frank McCullough. August 1972. 239 pages.

#### **PB-220 858**

Temperature cracking is a widespread problem for flexible pavements. In the reported research, a system was developed to predict the amount of temperature cracking in asphalt concrete surfaces throughout their service lives using laboratory materials data and available weather information. Four models were developed in the system: Simulation of bituminous pavement temperatures; estimation of asphalt concrete stiffness as the function of temperature and loading time, prediction of in-service asphalt aging, and estimation of thermal stresses; prediction of low-temperature cracking; and prediction of thermal fatigue cracking, providing an improvement over other available techniques due to daily temperature cycling. A computerized system for making the predictions was developed. The methodology may help a highway design engineer to select the asphalt concrete mixture design that can best eliminate or reduce temperature cracking in a road for a particular area.

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### **USE OF SYNTHETIC RUBBER-IN-ASPHALT PAVEMENT TO DETERMINE MIXTURE BEHAVIOR, PAVEMENT PERFORMANCE, AND THERMO- RHEOLOGICAL PROPERTIES**

Utah State Highway Department; and University of Utah, Department of Civil Engineering. Victor K. Sorbe, Chern C. Sy, J. E. Fitzgerald, and James S. Lai. March 1973. 450 pages.

#### **PB-220 940**

A project is reported to evaluate whether or not a synthetic rubber additive can beneficially modify asphalt cement and thereby enhance the qualities of a bituminous concrete pavement produced therefrom. Sixteen experimental pavement sections were constructed, each 150 feet long. A statistical analysis is given of the data obtained for five factors: bituminous surface thickness, gravel base thickness, rubber solids used, asphalt viscosity characteristics, and asphalt content. Trends were sought and a discussion is made of results on bituminous concrete with a three percent rubber and

high asphalt content, with high viscosity. The observations are expected to be of assistance when standard viscosity and ductility requirements cannot be met.

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## **USE OF DOMESTIC WASTE GLASS FOR URBAN PAVING**

University of Missouri, Department of Civil Engineering. W. R. Malisch, E. E. Day, and B. G. Wixson. 1973. 105 pages.

### **PB-222 052**

The report summarizes research on the use of waste glass as an aggregate in asphaltic paving mixtures. Reusing waste glass in this manner is discussed as an outlet for large quantities of such glass, as well as an opportunity to permit recycling in urban areas where large accumulations of glass are found. Field tests as well as observations of pavement performance are noted, which generally indicate that field installations of asphaltic paving mixtures containing glass have generally maintained adequate skid resistance and have performed acceptably from a structural standpoint. The economic feasibility of using waste glass as an aggregate in asphaltic concrete is seen to depend primarily on developing resource recovery systems that can separate glass along with other recyclable components and generate enough revenue from their sale, plus disposal and processing fees, to produce an acceptable return. Data were obtained from a number of widely dispersed geographic areas.

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# **PUBLIC HEALTH**

## **PROPERTIES OF ENDOD (*Phytolacca dodecandra*): PILOT SCALE PRODUCTION AND QUANTITATIVE FIELD EVALUATION OF THE BUTANOL EXTRACT IN ETHIOPIA**

Haile Sellassie I University (Addis Ababa), Institute of Pathobiology; and University of California (San Francisco), Hooper Foundation. Sheldon C. Crane, Aklilu Lemma, and Donald C. Heyneman. June 1973. 17 pages.

### **AD-765 902**

A practical method has been developed for concentrating the molluscicidal principle from berries of the plant endod (*Phytolacca dodecandra*). This involves a water extraction of dried ground berries, followed by butanol extraction of the water extract. A description is given of the design and construction of a pilot plant based on this method. The first year of a continuing agronomic study of endod is also described. Included in the study is a determination of the distribution of the plant in Ethiopia, and the selection of potent high-yield strains. Toxicity testing of the butanol extract from different strains against *Biomphalaria* snails, the predominant intermediate hosts for *Schistosoma* in Africa, is also being undertaken.

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## **FUNCTIONAL ANALYSIS OF HEALTH NEEDS AND SERVICES**

Johns Hopkins University, Department of International Health. December 1970. 510 pages.

### **PB-218 031**

Regardless of geographic setting, the accommodation of health needs to available resources is a confrontation with the principles of scarcity. Faced with this reality, health planners and administra-



tors have sought concrete evidence of the nature and extent of health needs as a rational basis for setting priorities. This document concerns the development of a conceptual framework for the functional analysis of health needs and services and the testing of simple, yet comprehensive, methods of measurements to provide specific information for such analysis. Both the developmental and testing work were based on field efforts in India and Turkey.

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## **TECHNOLOGY AND HEALTH CARE SYSTEMS IN THE 1980's**

National Center for Health Services Research and Development.  
1973. 265 pages.

### **PB-220 613**

There is considerable conjecture in regard to health care in the future. The report documents the presentations in a 1972 symposium held in San Francisco, CA. Speculations of the participants covered the social, political, and economic realms, involved in health care coupled with technological impacts. It would appear that each paper attempts both to instruct and to underline the expectation that the people as well as the health care system will be changing. Some other considerations are education, institutional goals, program planning, consumer relations, public administration, alternative systems, problems, priorities, and cost-benefits.

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## **SOCIAL SCIENCES**

### **LEADERSHIP THROUGH AN UNDERSTANDING OF HUMAN MOTIVATION WITH SPECIAL APPLICATION TO A PARTIALLY INDUSTRIALIZED COUNTRY**

Naval Postgraduate School. Ali Saraf-Yazdy. June 1973. 87 pages.

**AD-765 702**

Historically, the approach to governing and managing people has been through the use of authoritarian leadership. This style began with absolute rulers and was adopted by military, commercial, and industrial leaders. The more progressive leader, however, leads by using various forms of motivation. The modern manager must become familiar with and skilled in the application of leadership through motivation. Consideration is given to various aspects of this premise. The topics include: Leadership and its various styles; leadership as a function of the group and of the situation; an introduction to motivation; classification of human needs; application of leadership through Maslow's hierarchy of human needs; application of leadership through participative management; application of participative management in a partially industrialized country; pitfalls of participative management.

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### **LAW OF THE SEA, V**

University of San Diego, School of Law. Lee Metcalf, John G. Laylin, H. Gary Knight, et al. May 1973. 283 pages.

**COM-73-11451**

This is the fifth in a series of annual publications dealing with law of the sea. The topics covered include: Deepsea mining; development of US seabed policy; the 1972 Ocean Dumping Convention; high seas intervention, with particular reference to intervention in the case of oil spills; synopsis of recent developments in the law of the seas; legal status of seamounts and guyots under current international law; jurisdictional problems created by artificial islands; the Senkaku Island dispute as a demonstration of the inadequacies of current international law.

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## **AGRICULTURAL INNOVATION AMONG INDIAN FARMERS**

Social Sciences  
(continued)

National Institute of Community Development (Hyderabad); and Michigan State University. Prodipto Roy, Frederick C. Fliegel, Joseph E. Kivlin, and Lalit K. Sen. May 1968. 118 pages.

### **PB-216 057**

In view of India's food shortage, it can be stated that it is ultimately the individual farmer who decides whether the nation will or will not be adequately fed. A better understanding of the farmer's decision-making process may well contribute to the achievement of higher levels of food production and to higher individual productivity. This document provides the results of a study that was undertaken in Andhra Pradesh, Maharashtra, and West Bengal to, in essence, determine why one farmer adopts a modern agricultural practice (e.g., the use of chemical fertilizers) while another farmer in the same community does not. Consideration is given to the problem of measuring agricultural innovativeness; the relation of the farm setting to agricultural adoption; the relation of certain economic variables (farm size, fragmentation of the cultivated land into noncontiguous sections, percentage of products raised which is sold, number of different crops sold, and labor efficiency) on agricultural adoption; the personal characteristics of the farmer and certain aspects of the social context in which he makes decisions; various channels of communication and their role and influence in the adoption of agricultural practices; influence of the social-psychological make-up of the farmer on his adoption behavior; and the major factors that facilitate or constrain a farmer within his village from adopting recommended farm practices.

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## **INTERNATIONAL PERSPECTIVES ON SOCIAL WELFARE RESEARCH: REPORT ON AN INTERNATIONAL SYMPOSIUM**

The Brookings Institution. A. Eric Bubeck (Ed.). 1972. 176 pages.

### **PB-216 596**

In realization of an urgent need for progress in social welfare planning and for research in international social welfare cooperation, a three-week symposium was held in 1971. It began with a week of plenary and subgroup sessions in Washington, D.C., followed by a week of field visits allocated to the participants among the cities of Chicago, IL; Albany and New York NY; and Athens and Atlanta, GA; and concluded in Washington, DC. Papers presented in Washington and during the field visits covered such topics



as urgency and international programs, social welfare research issues, data base building, data utilization, social welfare development, social needs, social welfare services in Africa, Europe, South America, and Asia; and United Nations activities. Specific topics included such features as policies, female employment and the family, priority areas, alcoholism, and school lunches.

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**RURAL WORKS AND EMPLOYMENT:  
DESCRIPTION AND PRELIMINARY ANALYSIS  
OF A LAND ARMY PROJECT IN MYSORE  
STATE, INDIA**

Cornell University, Department of Agricultural Economics. W. Graeme Donovan. April 1973. 51 pages.

**PB-224 292**

A number of problems appear to be both fundamental and common to the developing countries of the world. Among these are rural socioeconomics and unemployment. In a predominantly rural area such as Mysore State in India, recently renamed Karnataka, the difficulty is compounded. The report covers a crash scheme for rural employment in India, with particular regard to a rural public works program in Mysore. This effort is directed toward providing immediate participation in economic life for a most poverty-stricken segment of the society, and increasing the productive capacity of the local economy. The works are known as the Third and Fourth Plans, conducted under a newly constituted government body called the Land Army, headed by a former army general and representing the various state departments at the Secretarial level. The objectives of the effort are to employ unskilled rural people in large working groups in the vicinity of their home villages. Consideration is given to the concept and organization of the Land Army; a particular operation known as the Alilusri-rama project; effects of the project on laborers; irrigation and the agricultural sector; roads; forest plantations; and expenditure effects.

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**UNEMPLOYMENT AS A SOCIAL PROBLEM IN  
URBAN COLOMBIA: SOME PRELIMINARY  
HYPOTHESIS AND INTERPRETATIONS**

Yale University, Economic Growth Center. A Berry. May 1972. 174 pages.

A continuing increase in open unemployment rates between the 1950's and 1960's in a number of less developed countries indicates that the problem may become more and more severe in the 1970's as rapid rural to urban population migration proceeds. A combination of urban mechanization and population growth in nations such as Colombia encourages such migration. The report discusses needed policy making in Colombia, which requires a detailed understanding of urban employment, as well as attention to the problem of overall income distribution. An economic hypothesis is advanced for the job market in that nation, relating unemployment to job-getting difficulty, lack of skills, poor education, and the low labor absorption of modern industry and other urban sectors. A second hypothesis is that interactions of these factors can lead to future aggravation of problems as time goes on. Considerable statistical data are given, and some indications are made for future policy making.

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# TECHNOLOGY TRANSFER

## INDUCED INNOVATION: A CRITICAL REVIEW OF THE THEORY AND CONCLUSIONS FROM NEW EVIDENCE

University of Minnesota, Department of Agriculture and Applied Economics. Hans P. Binswanger. December 1972. 46 pages.

**PB-219 693**

The report discusses transfer of technology to developing countries as related to weaknesses. Should a country simply import techniques from the developed nations without adapting them to its own endowments, labor saving will result but labor incomes and employment are seen as not rising much or even declining. If, however, the country develops its own techniques, labor income and employment should rise. The induced innovation hypothesis maintains that this improvement is possible. The basic idea of induced innovations is that any biases arise, not outside the economic system, but within the national economy. Theoretical models of induced innovation are discussed, and as an example a comparison is made between agricultural developments in the US and Japan. The results indicate that capital, technological, natural resource, and similar biases are indeed endogenous.

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## TECHNOLOGY TRANSFER AND TECHNOLOGICAL INNOVATION: ANNOTATED AND SELECTED BIBLIOGRAPHIES

Forecasting International Ltd. July 1973. 105 pages.

**COM-73-11374**

The interrelation of government and private sectors is complex, and not enough has been systematized to allow prediction of the effect of a change in government policy on technological innovation. Consequently, various hypotheses on policy implications are being tested. This annotated bibliography relates to three policy-involved program areas: Government procurement practices, government regulatory practices, and federal assistance to inventors and small R&D firms. Materials with relevance to government action and general significance include entrepreneurial motivation, social forecasting, technical assistance, information management, spin-offs, inventor incentives, investments, computer aided systems analysis, forecast validity, alternatives in planning, environmental engineering, ecological factors, developing countries, public opinion, management, and urban problem solving.

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# TRANSPORTATION

## **TECHNOLOGICAL FORECASTS, 1975 - 2000: A DESCRIPTIVE OUTLOOK AND METHOD FOR QUANTITATIVE PREDICTION**

US Department of Transportation. E. I. Golding, W. D. Velona, and B. Poole. May 1970. 354 pages.

**AD-754 178**

A review is made of the developments and feasible concepts in transportation technology which appear to offer opportunities for improving domestic transport of goods and people. Technological trends are noted for favorable change during a 25-year period beginning in 1975. New concepts and operating characteristics are described, along with expected research and development costs and time requirements. A methodology is drawn up for predicting the modal choice of passengers over the forecast period, and especial attention is given to predicting the modal split for the movement of goods. A methodology is outlined for the measurement of the impact of transportation on various factors such as safety, pollution, and noise. Identification is foreseen of the capital investment requirements for particular new systems, as well as relative merits and the funding levels of research and development which are necessary. Considerable statistical data are given in the form of tables and charts.

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## **DEVELOPING NATIONS AND OCEAN TRANSPORTATION, AN ANALYSIS OF PRICE AND COST OF OCEAN TRANSPORTATION, THE BALANCE OF PAYMENTS, AND THE CASE FOR NATIONAL MERCHANT MARINES WITH SPECIAL REFERENCE TO SOUTHEAST ASIA**

University of Wisconsin. Bernhard Abrahamsson. September 1967. 55 pages.

**PB-215 969**

One serious problem besetting a developing nation is its dependence on a third country for shipping services between it and an destination country. Two major grievances in this dependence are that liner freight rates are unduly high and discriminatory against the exports of the developing countries, and that the balance of payments is strained by the large freight payments. A review is made of freight rate policies and increases, following which the report develops a shipping model involving a number of factors, such as rate setting according to what the traffic will bear, profit

maximization, tramp vs. liner services, fixed-to-variable cost ratios, supply-to-liner-capacity curves, and demand-to-tramp-trade curves. Implications of this model to national tonnage and operations of merchant ships are discussed. The influence of cargo preference is noted. Factors influencing the cost structure are outlined, including port characteristics: costs, facilities, and capacities; equipment efficiency, automation, and delay time. Attention is given to containerization, new ship design, and harbor improvements. Particular reference is made to Southeast Asia. An indication is made of policies that developing countries might pursue to secure lower freight rates.

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### **1972 WORLD SURVEY OF CURRENT RESEARCH AND DEVELOPMENT ON ROADS AND ROAD TRANSPORT**

International Road Federation. December 1972. 385 pages.

#### **PB-217 122**

The report covers the ninth year of a continuing survey and inventory of information and activities relating to highways in countries outside of the United States of interest to those concerned with the broad fields of road transportation and roads. A total of 2329 studies, with brief abstracts, are reported from 69 countries, classified by country and technical subject. Two special in depth studies are included: Design and operational experience on high speed freeways; and fatigue failure and stress corrosion problems of bridges. Sections are devoted to objectives, cooperating organizations, and guidelines; survey analysis; and conclusions and recommendations. A few of the topics covered are pavements, weather conditions, accident factors, side and access roads, traffic simulators, road signs and markings, impact on urban area, park and ride installations, driver behavior, and reconstruction.

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### **AN ANNOTATED BIBLIOGRAPHY ON URBAN GOODS MOVEMENT**

Northwestern University, Transportation Center. Peter L. Watson. November 1972. 101 pages.

#### **PB-219 107**

Newcomers to the field of urban goods movement are confronted with a mass of literature without much guidance as to its importance or relevance, thus this bibliography. There are 275 entries from books, articles, reports, and other source materials on the urban environment, cargo handling and transport, vehicles, and facilities. An abstract is given with each citation. Indexing is by author and by 19 subjects, including trucking, terminals, movement studies, railroads, urban planning, models, highways, mass



transit, transport economics, location, distribution, services, regulations, goods transfer, traffic and congestion, transportation demand, manuals, general considerations, and miscellaneous factors.

Transportation  
(continued)

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## **SUMMARY DATA FOR SELECTED NEW URBAN TRANSPORTATION SYSTEMS**

Transportation Systems Center. Robert F. Casey. November 1972. 152 pages.

### **PB-219 254**

The tremendous interest in revitalizing urban transportation systems has produced a multitude of innovative or unconventional modes on paper, but most appear unlikely to be constructed. The report concentrates on systems that either have great appeal or that may be ready for realization within five years. Twenty-two of these innovative systems are listed, several of which are already fairly well known. Tabulations and discussions are presented of personal rapid transit and circulation system vehicle sizes and capacities, loaded weight, primary support or suspension methods for providing contact or lift between the vehicle and the guideway, and secondary suspension devices to provide comfort. Propulsion methods include dc traction motors, ac linear, ac induction, ac synchronous, dc linear, linear air turbine, and internal combustion motors. Switching systems are described. An analysis of performance to be expected involves speed, power, and acceleration-deceleration. Some anticipated costs are estimated, with particular reference to vehicles, guideways, communications and control, and terminals. Some current installations are described. Potential sites are noted, and the requirements for research and development are considered.

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## **INVESTMENT STRATEGIES FOR DEVELOPING AREAS: MODELS OF TRANSPORT**

Massachusetts Institute of Technology, Department of Civil Engineering. Richard de Neufville, John Hoffmeister, and David Shpilberg. January 1973. 93 pages.

### **PB-219 292**

Models of air and river transportation are developed in this document for use in the comparison of alternative investment strategies in transportation for developing areas. The models represent deliberate attempts to transfer technology known to be appropriate for individualized regions to situations characteristic of less developed areas. Overall, it is suggested that air transportation is the most cost-effective means of providing a desired level of service for sparsely inhabited areas (for example, the Colombian Llanos).



Where available, water transportation is most cost-effective for the longer hauls with more traffic. More detailed considerations affecting these generalizations are discussed.

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### **ROLE OF AIR TRANSPORTATION IN SPARSELY DEVELOPED AREAS**

Massachusetts Institute of Technology, Department of Civil Engineering. Richard de Neufville, Ulpiano Ayala, Jorge Acevedo, and Luis Mira. June 1972. 174 pages.

#### **PB-219 293**

The role and relative desirability of air transportation in developing areas is examined in this document, with specific reference to the Colombian Airline SATENA. An extensive theoretical analysis was performed to develop guidelines for an overall policy for air transport in sparsely inhabited regions. Consideration is given to planning and assessing transportation investments in the regional planning context, and to the choice of techniques for the evaluation of transportation investments in a labor surplus economy. A model for the choice of transportation technology is developed that provides guidance for planning optimal strategies investments in transportation by use of different technologies. The model shows that under certain circumstances air transportation has significant cost and service advantages over alternative modes. A case study of SATENA provides confirming evidence that the conclusions reached are reasonable.

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### **INVESTMENT STRATEGIES FOR DEVELOPING AREAS: ANALYTIC MODEL FOR A CHOICE OF STRATEGIES IN HIGHWAY TRANSPORTATION**

Massachusetts Institute of Technology. Fred Moavenzadeh. January 1973. 245 pages.

#### **PB-219 294**

### **INVESTMENT STRATEGIES FOR DEVELOPING AREAS: HIGHWAY COST MODEL OPERATING INSTRUCTIONS AND PROGRAM DOCUMENTATION**

Massachusetts Institute of Technology. Fred Moavenzadeh, Martin Becker, and Thomas Parody. January 1973. 353 pages.

#### **PB-219 295**

These documents present a computer model, the Highway Cost Model (HCM), that is designed to estimate costs of various investment strategies for low-volume roads in developing countries. The model's principal function is its ability to estimate costs rapidly, accurately, and inexpensively for alternative strategies. It

views highway transportation as a production process that uses construction, maintenance, and vehicle operation costs as inputs and highway transportation services as outputs. There are three functional submodels: a construction cost submodel, a maintenance cost submodel, and a vehicle cost submodel. These submodels simulate each year of roadway life. A routine for overall accounting and control services to record total discounted costs; it also controls flow between submodels. A series of network routines is incorporated into the model to allow the user to analyze certain series of staged construction and uncertainties in traffic projection.

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## THE SENSITIVITY TO TRAFFIC ESTIMATES OF ROAD PLANNING IN DEVELOPING COUNTRIES

Transport and Road Research Laboratory (Great Britain). J. D. G. F. Howe. 1973. 33 pages.

### PB-219 618

A recent study of traffic counting methods in developing countries showed that estimates of rural traffic flow were subject to considerable error. An analysis has therefore been undertaken to determine the effect of errors in the traffic estimates generally used in reaching planning decisions. Consideration was given to decisions concerning annual amounts spent on maintaining each section of the road, the economic justification of road improvements, and the selection of road design standards and hence construction costs. It is shown how each of these decisions is sensitive to the traffic parameters used in making them. The need for improvements in traffic estimations methods and for further research into the fundamental characteristics of rural road traffic in developing countries is stressed.

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## A STUDY OF ACCIDENT RATES IN DEVELOPING COUNTRIES

Transport and Road Research Laboratory (Great Britain). 1973. 35 pages.

### PB-220 133

Although road accidents may not seem as important in developing countries as the problems of malnutrition, financial and economic difficulties, and lack of education, loss to a nation is proportionately greater, since facilities affect largely the small minority of educated administrative, professional, and industrial people. The document reports on vehicle ownership increase and the relationship level to fatality rates. It is suggested that the developing nations should improve the road accident situation while in a relatively early stage of development, since it is easier to incorporate safety features into roads during construction than afterward.



Furthermore, attitude and policy changes made at the early stages of development would have a profound and continuing influence on road accident rates as traffic increases. Statistics are presented and compared to those of Great Britain during a development phase. A severity index is described correlating casualties and fatalities with ownership. A relation with motorcycles and scooters is noted. Possible methods of continuing road accident research in developing countries are discussed.

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## **PUBLIC TRANSPORT INNOVATIONS IN PRINCIPAL EUROPEAN CITIES**

Carnegie-Mellon University, Transportation Research Institute.  
Lester A. Hoel. May 1973. 52 pages.

### **PB-221 419**

This document provides descriptions of activities and innovations in urban transport in selected European cities. The purpose is to illustrate the range of solutions that have been attempted in recent years to improve the quality of public transport and increase urban mobility. The cities included are Hamburg, Gothenburg (Sweden), Montreal, London, Paris, and Rotterdam. In addition, recent experience in design and construction of an innovative new town, Runcorn, England, is cited as an example of a transportation and land use plan aimed at reducing the need for private cars.

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## **NEW SYSTEMS REQUIREMENTS ANALYSIS PROGRAM: TRANSPORTATION SYSTEM EVALUATION INDICATORS**

Peat, Marwick, Mitchell & Company. May 1973. 152 pages.

### **PB-221 572**

Transportation system evaluation indicators may be simply defined as quantitative or descriptive measures of attainment of objectives. The intent of the study was to develop a set of these indicators for use in multimodal transportation planning. Since the planning process reflects a great variety of objectives, many of which are often in conflict, there must be an evaluation component for trading off the objectives, one against the other. The report identifies criteria in the planning process, and discusses available methods for assessment of achievement of objectives. The analysis is organized about four reference or actor groups, each of which views the transportation system in a different light and therefore has a different set of objectives. These are the users of transportation services, the nonusers who nevertheless are impacted, the operators who supply the services, and the aggregate individuals making up the community.

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# **WASTE PROCESSING AND MATERIALS RECOVERY**

## **WASTEWATER TREATMENT TECHNOLOGY (2nd ed.)**

Illinois Institute of Technology. J. W. Patterson, and R. A. Minear. February 1973. 370 pages.

### **PB-216 162**

State-of-the-art surveys of waste treatment literature are provided on 23 substances likely to be encountered in industrial wastewaters. The surveys present pertinent information on existing methods of treatment, levels of treatment, and costs associated with treatment. The substances or factors covered are: Arsenic, barium, boron, cadmium, chloride, chromium VI, chromium III, copper, cyanide, fluoride, soluble iron, total iron, lead, manganese, mercury, nickel, oily wastes, pH control, phenols, selenium, silver, total dissolved solids, and zinc. This edition supersedes an earlier document of the same title, PB-204 521, listed in AMTID, July 1972, page 16.

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## **DESIGN GUIDES FOR BIOLOGICAL WASTEWATER TREATMENT PROCESSES**

University of Texas, Center for Water Resources, J. F. Malina, Jr., R. Kayser, W. W. Eckenfelder, Jr., E. F. Gloyna, and W. R. Drynan. August 1971. 126 pages.

### **PB-216 727**

This document provides a set of guidelines for the design of biological processes for the treatment of municipal wastewater. The equations and factors that must be considered in the design of the activated sludge system, the contact stabilization system, trickling filter plants, aerated lagoons, and waste stabilization ponds are identified. The applicability and limitations of each system are discussed, and a mathematical model of each process is established. The need for waste characterization, including variations in quantities in flow and composition of flow, is emphasized. The significant design considerations are discussed, design procedures are outlined, and design calculations are developed.

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## REMOVAL OF ALGAE FROM WASTE STABILIZATION POND EFFLUENTS: A STATE OF THE ART

Illinois State Water Survey. V. Kothandaraman, and Ralph L. Evans. 1972. 11 pages.

### **PB-220 300**

Treatment of urban, industrial, and agricultural wastes by means of stabilization ponds or lagoons has been increasing in recent years. Invariably, a significant load of algae collects, and it becomes imperative either to design these facilities on a total wastewater retention basis or to separate the algae from pond effluents and dispose of the harvested residue. The report summarizes investigations on methods of harvesting algae and disposing of the harvest; the results may be helpful to engineers and stream pollution abatement agencies. Uni-algal cells have been found to carry a negative charge in the pH range 2—11; thus the chemical precipitation of algae has been postulated using charge neutralization, agglomeration, and sedimentation. Cationic polymers, lime, alum, and ferric salts have been effective in bringing about the coagulation and sedimentation of algal cells. Dewatering and drying of algal slurry can be economically carried out by sand bed application. The comparative costs of various methods are discussed, and uses of the harvested algae such as animal feed, soil conditioners, and energy sources are suggested.

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## SOLID WASTE AS FUEL FOR POWER PLANTS

Horner and Shifrin, Incorporated. 1973. 158 pages.

### **PB-220 316**

Metropolitan areas all face an increasing problem in the disposal of solid waste materials. At the same time, full advantage has not been taken of proven technology to use these materials. The report presents evidence that if municipal refuse is properly prepared, combined with coal in practical proportions and used for firing boilers, the results may be little, if any, different from entirely coal fuel. A study was directed toward determining the feasibility of burning prepared municipal refuse as supplementary fuel to pulverized coal in large suspension fired utility boilers. Adaptation of commercially available mechanical equipment for handling raw and prepared refuse was investigated. An evaluation was also made of the effects of the process on public health and air pollution control. The study is referenced to the St. Louis, MO., area, but the results appear applicable to other heavily developed metropolitan areas. A few topic references are garbage disposal, grinders, magnetic separators, pneumatic conveyors, fly ash, water tube boilers, and air pollution control equipment.

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## **PHYSICAL, CHEMICAL AND MICROBIOLOGICAL METHODS OF SOLID WASTE TESTING**

U.S. Environmental Protection Agency, Office of Research and Monitoring. D. F. Bender, M. L. Peterson, and H. Stierli (Eds.). May 1973. 211 pages.

**PB-220 479**

This manual provides a collection of physical, chemical, and microbiological methods for evaluating solid wastes and solid waste related materials. The latter includes products and potential pollutants resulting from the handling, processing, disposal, or recycling of solid wastes. Emphasis is on giving specific laboratory directions with adequate step-by-step explanations and only enough discussion to provide a sound general background. The document is intended to serve as a laboratory manual for the technician and a sound, though not exhaustive, background for the analyst who must evaluate the test results. In addition, some of the more sophisticated methods (for example, those for analyzing reclamation products) may be of value for persons involved in research rather than testing or monitoring.

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## **STATE-OF-THE-ART REVIEW OF PULP AND PAPER WASTE TREATMENT**

WAPORA, Inc. Harry Gehm. April 1973. 252 pages.

**PB-221 434**

A review is provided of the state of the art of the treatment of liquid effluents produced from the manufacture of pulp, paper, and related products such as building boards and felts of wood origin. The topics covered include: Productivity and economics of the industry; water quality problems of the industry; general processes employed for effluent management and treatment; advanced waste treatment; water reuse and reclamation; handling, treatment, and disposal of sludge; treatment in public facilities; origin of specific mill effluents and results obtained by treatment; cost of treatment; evaluation of common testing procedures for pulp and paper mill effluents; effluent monitoring. A bibliography of 373 entries is included.

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**Waste Processing  
and Materials  
Recovery  
(continued)**



# **WATER SUPPLIES AND HYDROLOGY**

## **ANALYZING THE ENVIRONMENTAL IMPACTS OF WATER PROJECTS**

Stanford University, Department of Civil Engineering. Leonard Ortolano (Ed.). March 1973. 432 pages.

**AD-766 286**

When a regional water project is recommended, its probable impact on the area is important, with more than simple forecasting involved. To study a proposed flood control reservoir, for example, a water quality specialist must consider river temperature changes, plus effects of these changes on quality standards and alternative uses of river flow. The landscape specialist visualizes the setting with and without the reservoir, including also pertinent esthetic criteria. An economist estimates induced shifts in flood-plain land values, but notes in addition which groups of people may experience gains or losses thereby. The reported study deals with evolving a conceptual framework for water project planning that can define and relate factors relevant to environment as well as management. It contains reviews of the physical, biological, and chemical aspects of impoundments, channelization, dredging, and spoil disposal, along with ecological, visual, cultural, and other induced impacts. The pertinent literature is cited.

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## **METHODS OF MEASURING SOIL MOISTURE**

McMaster University (Canada). Richard G. Wilson. 1971. 28 pages.

**COM-73-11266**

Proper drainage basin management requires synoptic hydrological data, calling for knowledge of the movement and storage of water in the land areas. Soil moisture, though important in itself, is related to climatology and the surface and subsurface hydrologic regimes. To understand the behavior of soil water, one must measure it. The manual deals with the main methods of volumetric soil moisture determinations, noting the advantages and problems associated with them. A description is given of the gravimetric method, the neutron scattering method, and gamma ray attenuation. Measurement of soil moisture tension is discussed. Some basic theory and techniques involved in soil water flow are presented. Experimental approaches for directly monitoring soil water fluxes and for determining moisture patterns by means of remote sensing are noted. Error analysis is also discussed.

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## **A STUDY OF THE CONTRIBUTION OF PRIVATE TUBEWELLS IN THE DEVELOPMENT OF WATER POTENTIAL IN PAKISTAN**

Water Supplies  
and Hydrology  
(continued)

West Pakistan University of Engineering and Technology; and  
Colorado State University. June 1970. 191 pages.

### **PB-216 027**

Pakistan is basically an agricultural country, so it requires adequate quantities of irrigation water. Tubewells provide a means of using ground water for this purpose, and a large number of these have been installed in the past decade. Most of them are privately owned. This document is concerned with the contribution of private tubewells in the development of water potential in Pakistan and the extent to which the private sector should be promoted to make effective use of tubewells. The number of tubewells in Pakistan was determined by actual counting. A survey of about 4000 representative tubewells in Pakistan was undertaken to provide data pertaining to engineering, agriculture, and economic aspects of their use. Pertinent information was also collected for public tubewells and nontubewell farms for comparison with private tubewell farms. Recommendations are made, based on the results of the study, for improved ground water use policies and action plans.

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## **IRRIGATION REQUIREMENTS AND CLIMATIC EVALUATIONS FOR VENEZUELA**

Utah State University, Department of Agricultural and Irrigation Engineering. Jerald E. Christiansen, and George H. Hargreaves. January 1971. 130 pages.

### **PB-216 313**

With increasing agricultural and natural resource development in Venezuela there is a correspondingly greater need for evaluating irrigation requirements for use in planning, design and in project operations, and for a better evaluation of climate as a resource in development studies. To this end, precipitation data are provided for 148 locations in Venezuela. Evaporation data are also given for 55 of these locations. Some new formulas are introduced for estimating evapotranspiration, and a careful analysis of the dependability of precipitation is given. The concept of a moisture availability index is elaborated. This material is made available for use by those who may desire a clear visual representation of moisture relationships and irrigation requirements.

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## **CASE STUDIES OF DESALTED WATER FOR IRRIGATION**

Bureau of Reclamation; and Office of Saline Water. E. S. Krous, J. T. Maletic, H. L. Parkinson, and C. van Hoer. March 1972. 297 pages.

### **PB-217 491**

This document develops data relating to the improvement of saline irrigation water (to levels of salinity varying from 50 to 1500 ppm) by the use of multistage flash distillation electrodialysis, vertical tube evaporator/multistage flash distillation (VTE/MSF), or reverse osmosis desalination processes. The data are based on case studies conducted in irrigated areas of Arizona and California. Some of the areas of concern considered in the document are: The costs and benefits associated with progressive decreases in the salinity of irrigation water supplies; possible means of introducing desalted water into irrigation supply systems; the applicability of current desalting technology to agriculture; and methods of more efficient irrigation to keep the total cost of water as low as possible.

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## **PARAMETER SELECTIONS IN TELEMETRY SYSTEMS FOR IRRIGATION**

South Dakota State University, Electrical Engineering Department. Aelred J. Kurtenbach, and Duane E. Sander. January 1973. 85 pages.

### **PB-217 876**

Automating irrigation practices permits greater efficiency in water use. An automated system requires a telemetry system to transmit the measurement of necessary parameters to a control point. This same telemetry system may also be used to remotely control the valves, gates, and pumps of an irrigation system. Alarms and system monitoring functions may be performed by a telemetry system. This report defines areas in which the electrical engineer can assist in developing irrigation automation. Attention is given to a telemetry system for data transmission from soil moisture sensors, and an automated control valve that accurately regulates water flow rates about set points determined by a central control. Present and future communication requirements for automated irrigation systems are discussed. Their dependence of design parameters on the dynamics of the irrigation system is also demonstrated.

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## THE ALUMINA-LIME-SODA WATER TREATMENT PROCESS

Water Supplies  
and Hydrology  
(continued)

Midwest Research Institute. J. W. Nebgen, E. P. Shea, and S. Y. Chin. January 1973. 74 pages.

### PB-218 326

Economic recovery of potable water from saline water depends in part upon achieving a high recovery of product water and a low volume of waste brine. This requires that raw brackish water be pretreated to remove hardness so that calcium sulfate will not precipitate in the water recovery process. This document describes the alumina-lime-soda pretreatment process, which has an advantage over the current lime-soda ash process in that the new process partially removes sulfate as well as calcium and magnesium. Removal of both the cation and anion significantly reduces the total dissolved solids content in product water. The state-of-the-art of the process is reviewed, and the process parameters are defined and proven. Consideration is given to the removal of boron, silica, iron, and manganese by the alumina-lime-soda process; economic aspects of the process; applications to high calcium-magnesium sulfate waters; and other possible applications (such as acid mine drainage, irrigation return waters, etc.).

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## THE ROLE OF DESALTING IN PROVIDING HIGH QUALITY WATER FOR INDUSTRIAL USE

SCS Engineers. Curtis J. Schmidt, and David Ross. December 1972. 153 pages.

### PB-218 465

An examination is made of the current and future industrial demand for high quality water to determine the applicability of desalination equipment to supplement and/or replace other high quality water production methods such as demineralization and distillation. The term "high quality water" is used here to indicate water that is low in dissolved mineral solids. Ten industries and industrial functions that require large quantities of high quality water are discussed in this report. The ten are: Conventional fuel electric power generation; nuclear power generation; industrial boilers; electronics; primary metals; chemical process, including synthetic fibers; motor vehicles; drugs; photographic supplies; and other industries (bottled water, food processing, paper manufacture, etc.). The use of high quality water in each of these is discussed, and the characteristics of typical water supplies used by them are reported. Candidate desalination systems and cost estimates are presented.

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## **PUBLIC WATER SUPPLY TREATMENT TECHNOLOGY**

American Water Works Association Research Foundation. Harry A. Farber, and Elwood L. Bean. 1973. 270 pages.

### **PB-219 075**

This document offers a critical review of operating practices, current problems, and research needs in the field of public water supply treatment technology. It includes information on resource, treatment, and distribution aspects. The intended audience is water utility management personnel, including administrative, professional, and technical personnel having responsibility for day-to-day decisions on the quality aspects of water supply operations. The document delineates the management aspects of problems of public water supplies which affect the production of high-quality potable water and its delivery to consumer taps; analyzes and evaluates present operating practices, procedures and processes; describes presently known procedures and processes not currently widely applied, and evaluates the effects if such were applied; develops and defines recommendations for research that would provide the basic knowledge needed to improve process control, operation, management, and standards; and provides a selective bibliography of technical literature concerned with quality aspects of public water supply sources, treatment, and distribution.

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## **URBAN HYDROLOGY: A SELECTED BIBLIOGRAPHY WITH ABSTRACTS**

U.S. Geological Survey, Water Resources Division. G. L. Knapp, and J. P. Glasby. December 1972. 214 pages.

### **PB-219 105**

An annotated bibliography of 650 selected references is presented as a data source for urban water management needs. The current strong interest in urban hydrology involves research on pollution severity as affected by waste treatment and effluents, storm runoff, solid waste disposal in dumps and sanitary landfills, housing and highway construction, land surface paving, and sewer installations. The document brings together abstracts with citations that pertain to the rainfall-runoff process, urban groundwater problems, precipitation changes, and model construction. Emphasis is given to technical advances of the past 10 years, and to the needs for new research. A few specific topics covered are fluid flow, watershed characteristics, river forecasting, urbanization problems, overflow locations, sedimentation, flood control, and drainage analysis.

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## **A MANUAL ON COLLECTION OF HYDROLOGIC DATA FOR URBAN DRAINAGE DESIGN**

Hydrocomp Inc. R. L. Linsley. March 1973. 62 pages.

**PB-219 360**

There is generally very little data available on urban storm flow and quality, and the application of modern methods to urban storm drain management is limited by this lack. This manual outlines data requirements for storm drainage design and suggests methods of collecting and processing the requested data. It is intended to assist engineers begin programs of data collection.

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## **DATA REQUIREMENTS FOR MODELING A GROUND-WATER SYSTEM IN AN ARID REGION**

U.S. Geological Survey, Water Resources Division. Fred Kunkel. March 1973. 24 pages.

**PB-219 588**

The discussion is in partial response to continuing inquiry as to what types of geologic and hydrologic data need to be collected in an arid region. Although mathematical formulas are known and the computer capability exists to model accurately an interrelated surface and ground water system in such a region, existing data are often insufficient to provide the needed inputs to the model. It is thought, however, that even an unverified model may be of considerable value in predicting future water levels and providing the basis for determining the direction and scope of future data collection programs to ensure a maximum return. For the purposes of discussion, data requirements are developed for a hypothetical desert ground-water basin.

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## **ECONOMIC ASPECTS OF IRRIGATION FROM GROUND WATER**

Utah State University. George H. Hargreaves. 1972. 23 pages.

**PB-219 711**

In many situations the use of ground water has produced both irrigation and drainage benefits, and pumping from underground reservoirs has relieved drainage problems. A number of factors are involved in successful operation. In the Philippines, for example, a pump irrigation program depended upon the proximity of qualified mechanics, repair facilities, and availability of spare parts. In the Modesto district of California a system of gravity drainage was replaced by ground water pumping with reduction in costs. The report discusses typical selected irrigation systems, their designs and estimated life expectancies, and comparative

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costs of fuel, operation, and maintenance, for six different crops including sugar cane and cotton. The main attention is to ground water in Brazil, and typical examples of economic analysis of ground water development are discussed. Estimates are made of the internal rate of return on investment for single- and double-crop situations under two irrigation systems—sprinkler and surface irrigation. In areas with limited ground water recharge it is suggested that the most economical use of ground water would be operating over a period of 15–20 years.

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## **PLANNING SMALL WATER SUPPLIES IN DEVELOPING COUNTRIES**

University of North Carolina, Department of Environmental Sciences and Engineering. Donald T. Lauria. November 1972. 141 pages.

### **PB-219 774**

The most serious problem facing developing countries regarding public water supplies is lack of funds. Other problems, however, also exist. Two of these are the concern of this document: (1) once funds are set aside for water systems, decisions must be made on the towns to receive them; and (2) once towns are selected, decisions must be made on the capacity of each system to be constructed. The selection of towns is basically a problem in investment timing; in developing countries it is usually resolved by value judgment and political fiat. The determination of water system capacity is fundamentally a question of investment scale; it is generally resolved by constructing to meet existing demands plus some excess capacity by applying design standards from the advanced countries. The need for better planning practices is apparent. A more rigorous methodology for deciding water supply timing and scale is therefore developed for small communities in developing countries.

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## **AERIAL REMOTE SENSING—A BIBLIOGRAPHY**

Water Resources Scientific Information Center. Donald B. Stafford. March 1973. 483 pages.

### **PB-220 163**

This bibliography contains bibliographic citations and abstracts of 272 publications on aerial remote sensing, with emphasis on the application to water resources, hydrology, and water pollution. Studies involving both aircraft and earth satellite mounted sensors are included. Subject and author indexes are provided. Many of the publications listed are available from NTIS.

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## **IRRIGATION EFFICIENCY: A BIBLIOGRAPHY**

Water Resources Scientific Information Center. April 1973. 424 pages.

**PB-220 349**

A bibliography, with abstracts, on irrigation engineering is provided. Among the materials presented are discussions of agricultural practices, arid land operations, automatic control systems, specific fruit and vegetable culture, benefit cost analysis, crop production and response, dikes, drainage systems, dynamic programming, economic feasibility, evapotranspiration, farm management, fertilization, flood irrigation, furrow irrigation, ground water, hydrologic cycle, efficiency, land reclamation, leaching, linear programming, mathematical models and model studies, nitrogen, plant growth, production function, application rates, reservoirs, runoff, saline soils, soil moisture, sprinkler and trickle systems, specific state data, water policies, conservation, demand, distribution, and management; and water reuse. Subject and author indexes are included.

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## **USE OF NATURALLY IMPAIRED WATER: A BIBLIOGRAPHY**

Water Resources Scientific Information Center. May 1973. 365 pages.

**PB-220 350**

In many regions, notably the arid ones, the natural water supply may be saline, alkaline, or bear in solution heavy quantities of various chemical compounds. A bibliography, with abstracts, on utilization of such waters is provided. Some of the materials included are saline water intrusion, aquifer characteristics, alkaline soils, agro-industrial complexes, arid lands, cation exchange, chemical analysis, crop production, desalination, drainage, ground water engineering, irrigation practices, operations in specific foreign countries, land reclamation, leaching, oases, osmotic pressure, plant growth, saline soils, salt tolerance, social aspects, stream flow, transpiration, water management, and water utilization. Subject and author indexes are included.

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## **SELECTED DIGITAL COMPUTER TECHNIQUES FOR GROUND WATER RESOURCE EVALUATION**

Illinois State Water Survey. T. A. Prickett, and C. G. Lonnquist. 1971. 66 pages.

**PB-220 415**

The use of digital computers in ground water resource management has grown rapidly in recent years. Solution of large sets of

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simultaneous equations involving cause and effect relationships in a wide variety of boundary conditions is possible. The report discusses digital computer program listings that can simulate one-, two-, and three-dimensional nonsteady flow of ground waters in heterogeneous aquifers under varying conditions of the water table, and for leaky and nonleaky artesian characteristics. Programming techniques are given involving time varying pumpage from wells, natural or artificial recharge rates, relationships of exchange between surface waters and the ground-water reservoir, evapotranspiration, and a mechanism of converting from artesian to water table conditions. Included are mathematical background, documented programs, theoretical vs. computer comparisons and field examples. A finite difference approach is used to formulate the equations of ground-water flow, and a modified alternating direction implicit method is used to solve the resulting equations. Considerable information is given in graphic form.

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### **HYDRAULICS OF SHALLOW FLOWS OVER STABLE ERODED SAND SURFACES DEFINED BY AREA SPECTRA**

Purdue University, Water Resources Research Center. J. F. Burney, and L. F. Huggins. February 1973. 138 pages.

#### **PB-221 347**

Estimation of the hydraulic response of a land surface to shallow overland flow is of major concern in the design of flood control and the dependent structures in small agricultural watersheds. An important factor is the depth-discharge relation. The advent of high speed digital computers has made feasible the rapid generation of runoff hydrographs indicating the effects of manmade changes. However, reliability of the hydrographs is limited by accuracy of input information and sensitivity to the depth-discharge relationship used. The objectives in the project were to develop, test, and evaluate instrumentation for recording the physical configuration of a natural, fallow land surface, including both grain and form effects, and to relate the information, if possible, to hydraulic response of the surface. The report discusses tests of two eroded sand surfaces, naturally formed and then stabilized on the bed of a rainfall simulator. Regression analysis results are discussed.

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### **ARTIFICIAL RECHARGE OF GROUND WATER: A BIBLIOGRAPHY**

Water Resources Scientific Information Center. February 1973. 309 pages.



**PB-221 479**

The report provides 210 abstracts of publications dealing with the artificial recharge of ground water. Some of the topics emphasized are artificial recharge operations, pit recharge, recharge wells, aquifers, conjunctive use, injection wells, reclaimed water, saline water intrusion, water management, water reuse, and withdrawal. Other discussions relate to specific states and foreign nations, pollution control, groundwater movement, hydrogeology, irrigation, mathematical models, waste-water treatment, and conservation. Subject and author indexes are included.

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**PREDICTION MODELING FOR SALINITY CONTROL  
IN IRRIGATION RETURN FLOWS**

Environmental Protection Agency, Robert S. Kerr Environmental Research Laboratory. A. G. Hornsby. March 1973. 59 pages.

**PB-221 647**

To anticipate the changes in salinity that must necessarily occur with increased use and reuse of irrigation water, prediction modeling provides a tool to be used in order that management practices can be instituted in time to prevent serious impairment of water quality for downstream users. Prediction models can anticipate changes in salinity in return flows and, also, aid in establishing the relative contributions of the individual processes that lead to salinity increases. Assessment of the relative contributions leads to improved management practices with the ultimate goal of reducing salinity levels in irrigation return flows while maintaining viable agricultural operation. This document provides a review of the current state of the art of prediction modeling as applied to salinity control in irrigation return flows. It will also serve as a reference source for researchers interested in prediction modeling related to irrigation return flows.

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**INSTALLATION AND FIELD USE OF CUTTHROAT  
FLUMES FOR WATER MANAGEMENT**

Colorado State University, Agricultural Engineering Department. Gaylord V. Skogerboe, Ray S. Bennett, and Wynn R. Walker. March 1972. 131 pages.

**PB-224 293**

Of the various devices developed in seeking more accuracy of measurement and more improvement in the management of water, measuring flumes have been the most promising. These embody an open channel structure containing a constricted section. A recently developed type is the cutthroat flume, a modified venturi configuration with a converging channel joined to a diverging one, a flat bottom and vertical walls, and without the usual parallel-

wall throat section. Its main advantage is economy, since fabrication is facilitated by its geometric simplicity. There is no silting problem. In addition, any particular flume length can have the same convergence, divergence, and wall lengths, allowing the same forms or patterns to be used for any throat in a width range of 1 inch to 6 feet. A flume is described that will operate satisfactorily under both free-flow and submerged-flow conditions. The differences between such conditions are described, together with the necessary criteria for determining which flow regime is operating. Examples are given, and proper installation and maintenance procedures for cutthroat flumes are described.

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### **CHECK-DROP-ENERGY DISSIPATOR STRUCTURES IN IRRIGATION SYSTEMS**

Colorado State University, Agricultural Engineering Department.  
Gaylord V. Skogerboe, Venus T. Somoray, and Wynn R. Walker.  
May 1971. 210 pages.

#### **PB-224 372**

To control the flow of irrigation water in a canal or ditch, checks and drops are used. The check structure for maintaining or increasing water surface elevation is designed so that flow needed downstream passes over or through it; there must be an energy dissipating component to prevent erosion of the downstream area. Earth-lined canals may use a portable prefabricated dam of plastic, canvas, steel, cinder block, or precast concrete; for concrete lined canals, precast grooves may serve as gate guides. The drop structure for gully control and the changing of steep slopes to mild ones employs a vertical or inclined drop and an energy dissipating device. The fall may vary from 12 to 24 inches for alluvial channels, to a maximum of 6 inches for field ditches. The report is concerned principally with energy dissipation. A compilation was made of the large volume of available literature on small energy dissipator structures. A discussion is given of mathematical derivations, design curves, the approach section, water surface profiles, free hydraulic jump, stilling basins, closed conduit systems, straight drop spillways, dissipation bars, bed and bank protection, and wave suppressors. A computer program is included for the evaluation of flow conditions at the base of small irrigation drop structures.

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### **CULVERTS AS FLOW MEASURING DEVICES**

Colorado State University, Agricultural Engineering Department.  
Va-son Boonkird. February 1972. 105 pages.

#### **PB-224 416**

Culverts, or transverse drains, are widely used in irrigation systems to constrict, divert, or deliver water by means of open or



closed channels. Hydraulic performance and capacity are determined by the culvert inlet, barrel, and outlet. The design engineer must consider unsubmerged or submerged inlets; barrel length, slope, and content; and outlet performance full or part full, involving critical depth and tailwater, free and submerged. The report considers culvert operation under free surface flow conditions, for which to date only an approximate solution has been available for determining discharge. A laboratory test is described using a 12-inch diameter corrugated metal pipe to investigate the validity of a submerged flow analysis employed with flow-measuring flumes and weirs in assessing free surface outlet control. Various slopes and culvert lengths were included, resulting in a set of discharge ratings that were studied for relationship for inlet control and submerged outlet control. The results indicate that a culvert may be used as a flow measurement structure in an irrigation system.

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### CUTTHROAT FLUME DISCHARGE RELATIONS

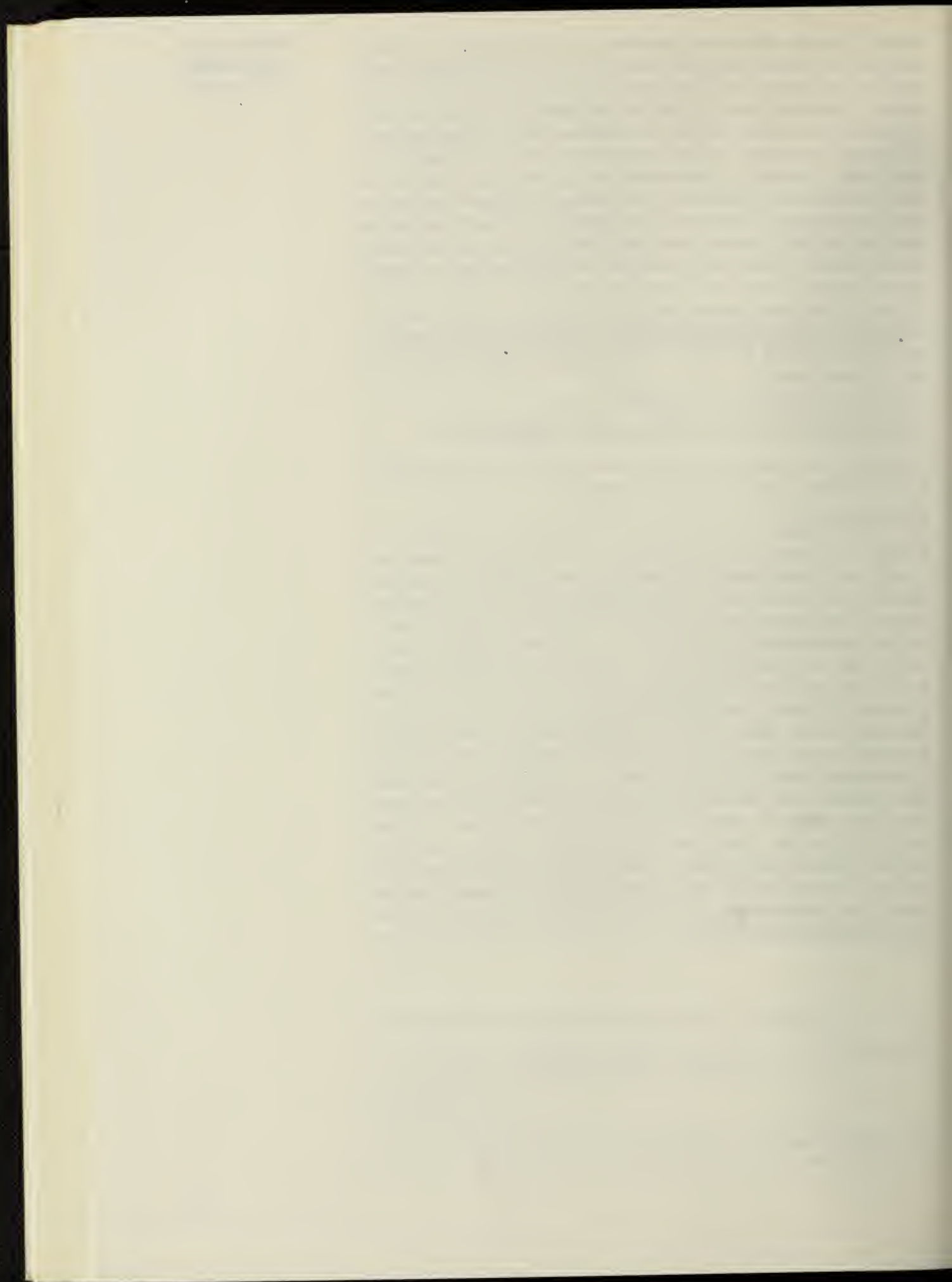
Colorado State University, Agricultural Engineering Department.  
Ray S. Bennett. March 1972. 134 pages.

#### PB-224 417

Satisfactory measurement of water flow in irrigation systems may be obtained by a flume—an open flow device with a constricted section. Such a structure is self-cleaning, accurate over a large range of discharges, sturdy, relatively simple to construct, excellent in maintainability since there are no moving parts, low in energy loss, and suitable for both stationary and portable operation. A device that shows especial promise is the cutthroat flume, or venturi without a longitudinal throat section. The purpose of the study was to rate a group of cutthroat flumes with the same geometric shape. Because of geometric similarity, the behavior of the entire family of flumes ought to be predictable within the degree of accuracy suitable for field use. Twelve similar flumes were investigated all with a length of 9 feet and a range of throat widths of 1–6 feet. The report begins with a historical development of flow measuring flumes, describes the development of the cutthroat flume, outlines the method of flow analysis, and discusses the experimental design, facilities, and results. Some recommendations are made.

—○—





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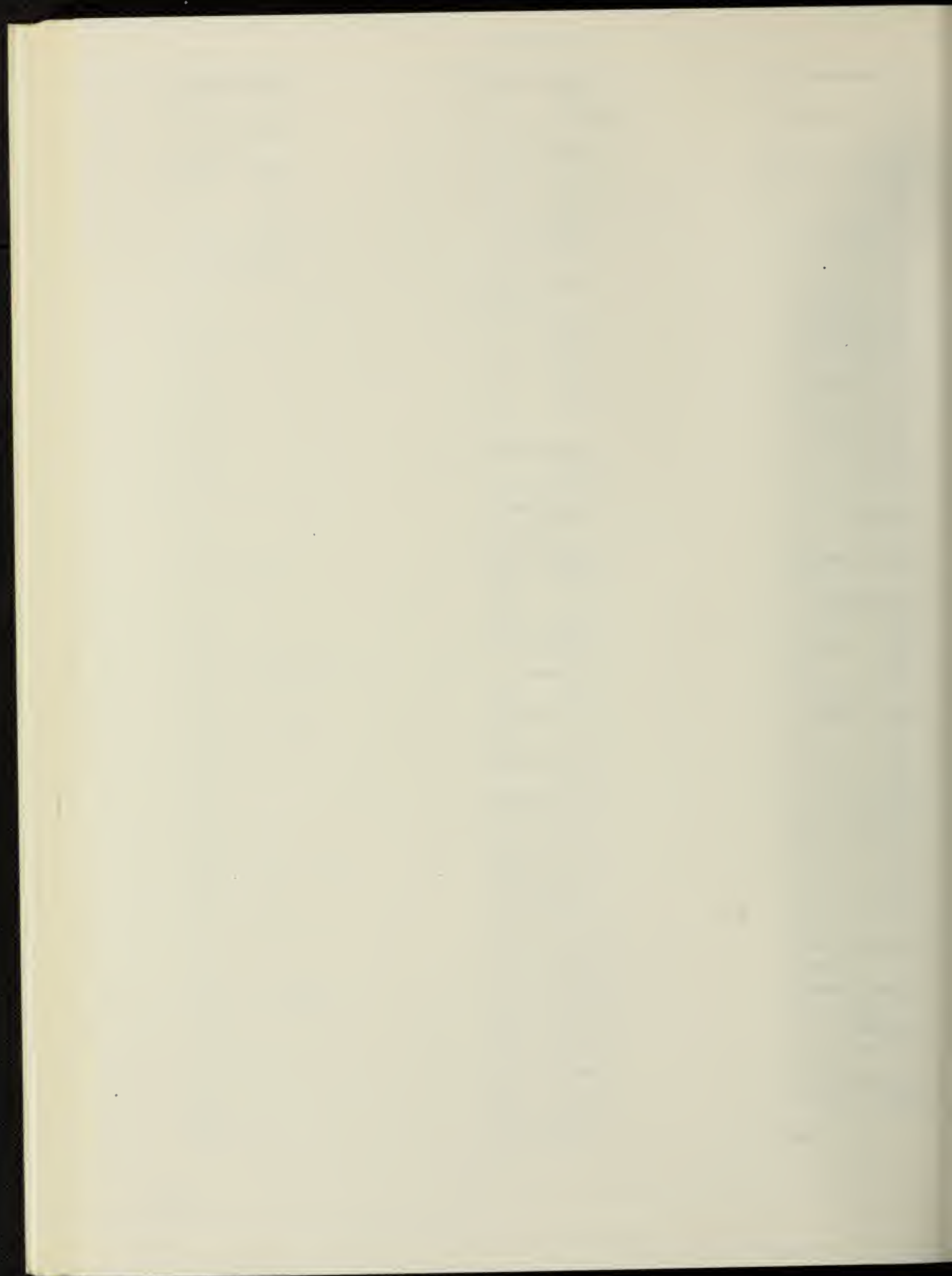
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# APPLICATION OF MODERN TECHNOLOGIES TO INTERNATIONAL DEVELOPMENT

Agency for International Development  
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May 1974

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## INTRODUCTION

*Application of Modern Technologies to International Development* (AMTID) is published as part of a program being carried out by the U.S. Agency for International Development (US AID) and the National Technical Information Service (NTIS). Its primary objective is to bring certain U.S. technical publications to the attention of interested individuals and organizations in developing countries to foster the transfer of technologies to these countries.

The reports described herein represent the results of research funded by the United States Government. Beginning with this issue, the subject coverage is expanded with emphasis on areas of particular interest in developing countries.

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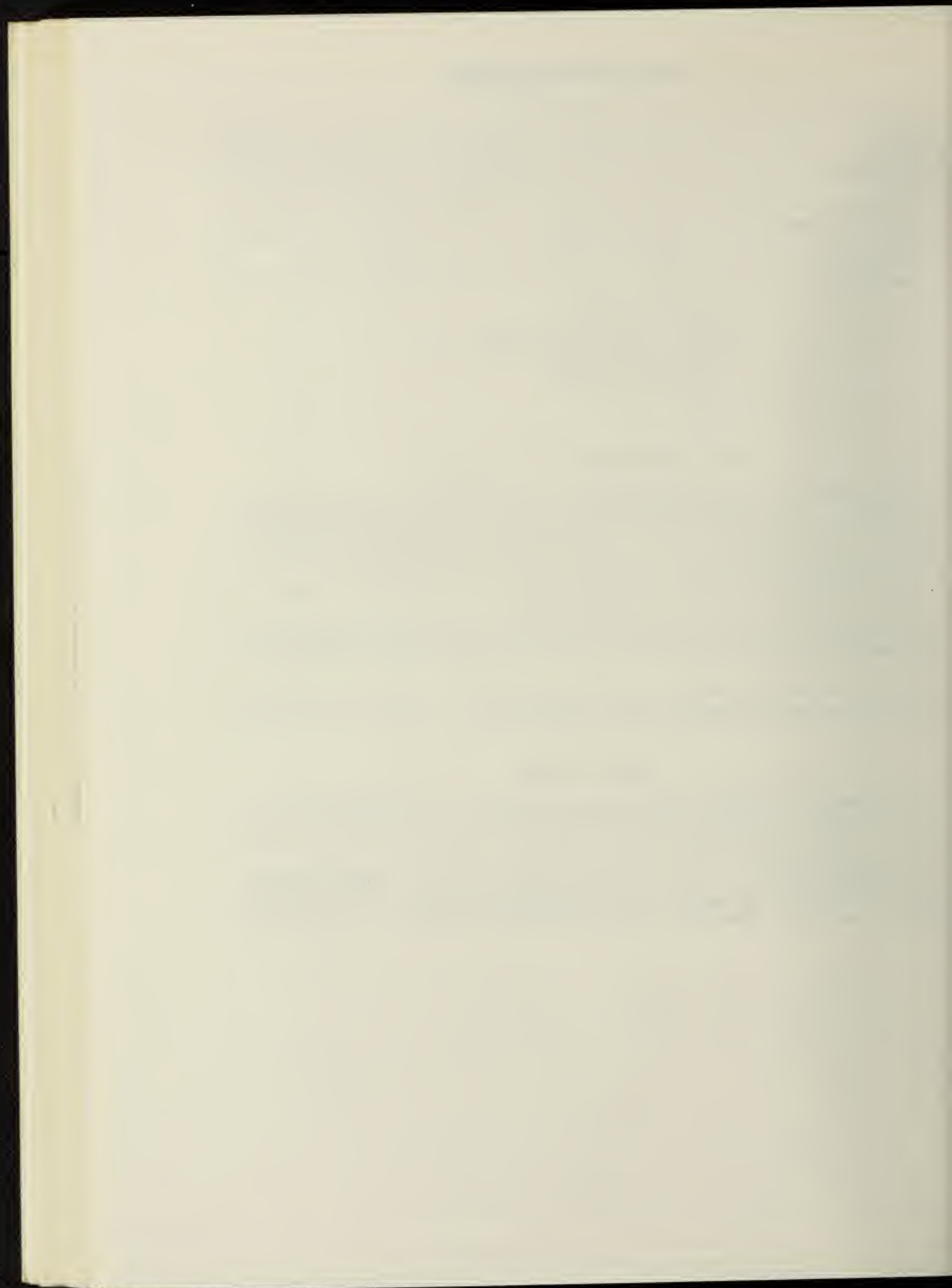
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# AGRICULTURAL ECONOMICS

Agricultural  
Economics

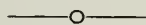
## METHODOLOGY AND GENERAL DATA

### DESCRIPTION: FARM LEVEL CAPITAL FORMATION IN SAO PAULO, BRAZIL

Ohio State University. Kelso L. Wessel and William C. Nelson.  
December 1971. 44 pages.

**PB-219 725**

This paper is directed toward formulating a better understanding of the diversities that exist in Brazilian agriculture. The focus is on the capital-formation process on farms, with particular emphasis on the role of credit and technology in bringing about rapid changes in production and productivity. The report covers an economic survey of 383 farms in the state of Sao Paulo, Brazil in 1970 in order to establish farm level data. Several homogeneous groups have been identified in the large cross section that reflect farm size, type, technology, tenure, and market orientation. Management level and mechanization are observed. Analyses are made of farm organization, income, consumption, savings, investments, and other factors that determine the production-income-growth process for each group of farms. In addition an assessment is made of the influence of external factors such as input-output prices, inflation, government credit programs, land tenure arrangements, technical assistance, and education. The sampling procedure is described, and criteria are presented. Various data obtained from the questionnaire used are tabulated.



### CHANGES IN AGRICULTURAL PRODUCTION IN BRAZIL, 1947-65

Department of Agriculture, Economic Research Service. Louis F. Herrman. June 1972. 98 pages.

**PB-219 750**

A comparative 1972 report is made on a developing country, data base 1965, which in that year used human labor as the only source of power on three-fourths of its farms. Statistical data are given for Brazil for the preceding 18-year period, in which agricultural output increased about 4.5% a year, mainly by expanding the cultivated area, but with a potential to double the area under cultivation. Tabulations are given of the contributions of land and



livestock numbers and productivity, contributions of factors complementary to land such as fertilizers, plant protection, seeds, irrigation, and labor; factors external to the farm such as domestic and foreign demand, agricultural financing and credit; organized land development, education, and foreign aid; and some implications for agricultural development.

---

### **ECONOMIC ANALYSIS OF AGRICULTURAL PRODUCTION AND LABOR UTILIZATION AMONG THE HAUSA IN THE NORTH OF NIGERIA**

Michigan State University, Department of Agricultural Economics.  
D. W. Norman. January 1973. 53 pages.

#### **PB-219 757**

Much of the area farmed by the Hausa and settled Fulani in the northern part of Nigeria lies in the Sudan and Guinea ecological zones. The case study presented in this document examines in some detail the farming practices and production of Moslem farmers in the Zaria area, which is situated in the northern part of the Guinea zone. Through the empirical description and analysis of the present situation, an attempt is made to suggest factors that would need to be taken into account if change to a less traditionally oriented system of agriculture were to be successfully introduced. More specifically, the document provides: A description of present day traditional farming in the Zaria area both in terms of inputs and outputs; an interpretation of empirical data and the results of tests of various hypotheses regarding the present situation, i.e. the influence of external factors such as the goals underlying farmers' actions, particularly profit maximization and security; and the derivation of some implications for introducing change.

---

### **NEW SEED VARIETIES AND THE SMALL FARM**

Cornell University, Department of Agricultural Economics. M. Schluter, and John W. Mellor. March 1972. 22 pages.

#### **PB-219 760**

It is generally accepted that a relationship exists between adoption of new seed varieties and size of farm. However, within this broad relationship there is considerable diversity in the adoption pattern between crops, seasons, regions, and years. The complex relationship is examined in this document, with emphasis on the adoption of new rice varieties by small farmers in India. Consideration is given to the proportion of farmers adopting and size of farm; proportion of acreage under the new varieties and size farm; and tenancy, irrigation and credit as factors affecting adoption.

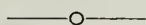
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## **AGRICULTURAL DEVELOPMENT AND FARM EMPLOYMENT IN INDIA**

Department of Agriculture, Economic Research Service. William J. Staub. January 1973. 122 pages.

**PB-219 778**

In India approximately 70% of the population resides in rural areas and derives its income from the farm sector. Furthermore, this is where much of India's population growth is occurring. Since the number of persons employed in nonfarm industries is relatively small, a large portion of the labor force will need to remain in farm or farm-related occupations. This document examines the influence of agricultural development on farm employment in India, with emphasis on the short-run demand for family labor and two types of hired labor—permanent and casual (seasonal). An effort is made to identify the set of variables that significantly influence the amount of labor employed per farm in the Ferozepur District in Punjab and the Thanjavur District in Tamil Nadu. An examination is also made of the similarities and differences that exist within and between the two regions with respect to the effects of variations in use of farm inputs on the farm level utilization of family and hired labor. Inferences are drawn with respect to four important issues related to the farm employment problem: (1) The general effect of agricultural development on farm employment; (2) The distribution of employment benefits among family and hired labor; (3) Farm mechanization and farm employment; and (4) Aggregate farm labor absorption. Insofar as the Indian experience is typical of other developing areas, these analyses provide insights into general factors influencing farm incomes and employment during periods of rapid change in farm production.



## **POLICY MAKING FOR ECONOMIC DEVELOPMENT: A SYSTEM SIMULATION MODEL OF THE AGRICULTURAL ECONOMY OF SOUTHERN NIGERIA**

Michigan State University, Department of Agricultural Economics. Michael H. Abkin. February 1972. 330 pages.

**PB-225 518**

Planning for the economic advancement of developing countries involves problems arising from the interplay of political, social, and economic subsystems that operate in a specific region. If an economic model can be formulated, the planning will be more systematic. The report considers a global computer model of the agricultural economy of Nigeria, with its regional and sectoral submodels. The approach to the southern Nigerian agricultural simulation submodel employs a lumped approximation to a distributed parameter process, involving the distribution of population over time and a set number of properties, and the demography

Agricultural  
Economics  
(continued)

of perennial commodities. Factors of importance are land allocation, modernization decisions, agricultural production, the processing and marketing component, price generation, policy entry points, and macro-budget accounting. Testing and validation procedures are discussed. One section discusses data needs and the process of tuning the model to track time series of recorded behavior. Policy applications are presented, along with experimental runs utilizing various agricultural development policy options. A summary is given, and some conclusions are drawn. Areas are outlined for further refining, improving, and extending the model.

---

### **EXPLORATION AND ANALYSIS OF PRODUCER PRICES OF OLIVES IN TUNISIA: A CASE OF PRICING IMPERFECTION**

University of Minnesota, Department of Agricultural and Applied Economics. Osama A. Al-Zand. January 1973. 49 pages.

**PB-225 641**

A study of the pricing of a primary agricultural commodity at the farm level requires an adequate interpretation and definition of the type of marketing systems in operation. This definition includes identification of the principal channels of marketing and the availability and cost of reaching these channels by producers. The olive crop in Tunisia is a most important national crop, but knowledge concerning its marketing, pricing, and channels of processing from primary producers to ultimate markets is scanty. At the same time the market for olive oil derived from Tunisian olives is broadly known and more organized. The report is concerned with the linkages between the two markets. Its general objective is to examine the validity of some underlying assumptions concerning the relationship between the actual primary product price of olives and the corresponding wholesale price of olive oil. Some of the marketing considerations include sale of olives on trees, sale of harvested olives on the farm, sale of olives in the market, sale of olive oil to a national outlet for domestic and export marketing, and sale of olive oil by traditional arrangements for local or family consumption. A statistical analysis is drawn up, some discrepancies are observed, and the findings are used to obtain recommendations for marketing reform and pricing efficiency.

---

### **INCOME DISTRIBUTION, EFFICIENCY AND THE EXPERIENCE OF COLOMBIAN FARM MECHANIZATION**

Rice University, Program of Development Studies. Wayne R. Thirsk. 1972, 58 pages.

**PB-225 651**



One proposition in the theory of economic policy is that the effects of introducing a distortion are uncertain if prior distortions exist elsewhere in the economy. The process of farm mechanization in Colombia illustrates a general equilibrium framework for analyzing second-best situations. In Colombia there appear to be significant disequilibriums in land, labor, and capital. Agriculture consists of a large-farm sector that produces crops or cattle and a small-farm sector that produces crops; the small farms are more labor intensive than the large ones. Impediments hinder the transfer of land from larger to smaller farms by sale or rental: lack of credit for sale, and agrarian laws that view rented land as inadequately used and thus liable to expropriation. Large landowners have tended to graze cattle in preference to growing crops, which are more labor intensive. A significant growth in mechanization has further complicated the situation, in that capital resources devoted to farm mechanization have deprived other sectors of the use of those resources. Two closely related models are developed involving capital exclusive of cattle, mechanizable and nonmechanizable land, and labor, considering the factors of non-agriculture, large farm crops, small farm crops, and cattle. The small farm sector is a repository of surplus labor. A smaller model and a larger model are described, the smaller containing 14 independent equations and 14 unknowns, the larger expanded to 21 variables. The solutions indicate adjustments in the structural composition of the economy that could be expected to result from subsidizing large farm capital in Colombia.

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## THE ECONOMICS OF OLIVE OIL AND OILSEEDS IN THE MEDITERRANEAN REGION

University of Minnesota, Department of Agricultural and Applied Economics. Osama A. Al-Zand. January 1973. 22 pages.

**PB-225 652**

During the past two decades the Mediterranean region has changed from a complete self-sufficiency in edible oil via its olive oil production to an import market among the greatest in the world. Countries involved are Italy, Greece, Turkey, Tunisia, Algeria and Morocco. Olive oil is only one of the edible oils consumed in the area, but there is only a limited production of oilseeds, which include soybeans, rapeseed, sunflower seed, groundnuts, and cottonseed. Most oilseeds are joint-product commodities, oil for edible uses and meal or cake for animal feeding. The oil is satisfactorily substitutable for olive oil. The report discusses the economic characteristics of these seeds, including storability for a relatively extended period of time without quality deterioration or loss, the establishment of new crushing methods that have produced a shift from importing oil and meal to procuring the seeds, and the responsiveness of oilseed production and marketing to

**Agricultural  
Economics**  
(continued)

the market price of the product. A fourth quality of most edible seed oils is their uniformity and recognized commercial standards. The economic analysis includes statistical data on per-capita consumption, and some long-term forecasting. Of special note is the perishability of olives, which must be processed immediately upon harvesting.

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# **AGRICULTURAL TECHNOLOGY**

## **WEED RESEARCH METHODS MANUAL**

Oregon State University, International Plant Protection Center.  
W. R. Furtick and R. R. Romanowski. 1971. 87 pages.

### **PB-219 663**

Economic losses and production setbacks due to weeds are now major considerations for many nations striving for agricultural self sufficiency. Weed control, preceded by establishment of exhaustive weed research projects, is now recognized as an inseparable part of a meaningful agricultural program. This handbook on weed control research techniques and methods is intended as an aid in helping prevent some common mistakes associated with weed control field research. Emphasis is on problems associated with establishing new programs. The reader is assumed to have some field experience or background in agricultural research. Subject matter covered includes: Cultural practices for experimental plots; weed control experimental procedures; experiments designed for limited objectives; determination of economic aspects of herbicide use; applicators for use in chemical weed control research; evaluating and reporting weed response to herbicides; evaluating crop response to herbicides; safe precautions in herbicide work; formulation and compatibility of chemicals.

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## **AGRONOMIC PRACTICES FOR OPTIMIZING THE YIELD POTENTIAL OF SHORT-SATURATED RICE VARIETIES IN LATIN AMERICA**

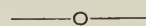
North Carolina State University, Soil Science Department. Pedro A. Sanchez. October 1971. 47 pages.

### **PB-219 713**

In the Latin American tropics, a number of new short-saturated rice varieties are now extensively cultivated in several countries. However, when farmers manage the new varieties as the old ones, they often get very limited yield increases or none at all. To maximize yields and profits from new varieties, different cultural practices must be applied, some of which require further investments and more precise timing. This document illustrates the varietal response to specific cultural practices as examples of the kind of information needed for optimizing yields in each rice



growing area. Some of the topics covered include: Time of planting in relation to weather patterns; planting systems, seed density, and spacing; fertilization; weed control; harvest timing; combined effects; and economic considerations.

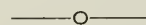


### **MANUAL OF PESTICIDE APPLICATION EQUIPMENT**

Oregon State University, International Plant Protection Center.  
A. E. Deutsch, and A. P. Poole. 1972. 138 pages.

#### **PB-219 908**

Acceptance and success of chemical crop protection methods are well documented in some geographical areas, but virtually unknown or just being introduced in other regions. An obvious need for safe, accurate, and convenient application has long existed but is even more acute today with the sharp increase in effectiveness and use of chemicals. Useful information and technical details about equipment manufactured for this purpose are widely scattered among many publications. As a result, individuals faced with considering or purchasing pesticide application equipment are often forced to base decisions on extremely limited information. This manual is an effort to present pertinent information organized in a single publication in an easy to use format. It is intended primarily for use in developing nations and by research workers. Therefore, emphasis is on equipment for use on small-scale land units. The manual is organized as follows: Names of all known manufacturers of application equipment are listed in alphabetical order for each of 30 equipment classifications; the names and addresses of all firms are listed in alphabetical order, with cross references to the product classification under which they appear in the previous section; representative equipment for most product classes is briefly described.



### **TECHNICAL CHANGE IN AGRICULTURE**

University of Minnesota, Department of Agriculture and Applied Economics. Willis Peterson and Yujiro Hayami. July 1973. 80 pages.

#### **PB-225 545**

The paper considers some major theoretical and empirical developments in agricultural technical change during the past 25 years. As in any other emerging field, some controversy and disagreement have emerged. The purpose has been to search out the controversial issues, and present as objectively as possible both sides of the major arguments. The report is largely a literature review but an attempt is made to contribute to the overall state of the art. The major theoretical developments relating to the concept of technical change are presented, drawing greatly on economics literature. Various techniques are discussed that have

been employed to measure productivity growth. Attention is given to the sources of change in agriculture, and a survey is made of attempts to measure the costs and return to research and extension. The diffusion of technology among farms, among regions, and among countries is noted, and the welfare implications are observed including both output increase and distributional effects.

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**Agricultural  
Technology  
(continued)**

## **THE FATE OF NITROGEN FERTILIZERS APPLIED TO TROPICAL SOILS**

Cornell University, Department of Agronomy. Francisco F. Ferreira-Azcona. August 1972. 134 pages.

### **PB-225 551**

Nitrogen is a limiting factor in food production because it is essential for plant growth and reproduction. Nitrogen compounds are assimilated rapidly. They can enter the plant as ammonium ions or nitrate ions, but the ammonium ion is transformed slowly to nitrate since the nitrate form is the one used by the plant. Nitrate movement through the soil is subject to great fluctuations as the result of warm and cold seasonal change in temperature and wet and dry periods in the tropics. The report is concerned with the behavior of urea and ammonium sulfate in some tropical soils, the nitrification rates of urea and ammonium sulfate, and the movement of nitrate in Puerto Rican soils under fallow conditions. Three soils studies were a sandy oxisol, a clayey oxisol, and a clayey ultisol. Nitrification rates of ammonium sulfate and urea did not appear to differ in these soils, the nitrate formed from these compounds moving with water through the profile at the same rate as chloride. Urea was found to be rapidly hydrolyzed to ammonium carbonate; the ammonium peak appeared in 14 days or less.

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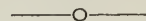
## **HANDBOOK OF SELECTION AND SEED GROWING OF OIL PLANTS**

Israel Program for Scientific Translations; US Department of Agriculture; and National Science Foundation. U. S. Pustovoit (Ed.). 1973. 310 pages. (Translated into English by N. Kaner from *Rukovodstvo po selektsii i semenovodstvu maslichnykh kul'tur*, Moscow, 1967)

### **TT-71-50100**

Oil seed crops, a primary source of calorie-producing and readily assimilable fats, occupy about 70 million hectares of the world farmland. This handbook is concerned with the theoretical and practical aspects of the selection and seed-crop growing of the following vegetable oil plants: Sunflower, castor-oil plant, seed flax, Indian mustard, soybean, peanut, and sesame. In each case, information is provided on the economic significance of the crops; the botanical and biological characteristics of the plants; and the

present methods for the development of initial stock, the selection and evaluation of plants, and selection techniques. Strain changing, strain renewal, and the processing of experimental data are discussed.





# **BUILDING TECHNOLOGY & STRUCTURAL ENGINEERING**

## **INFLATABLE, MODULAR, AND OTHER PRE-FABRICATED STRUCTURES. A DDC BIBLIOGRAPHY**

Defense Documentation Center, November 1973, 110 pages.

**AD-769 000**

This bibliography contains abstracts of reports of US Government sponsored research dealing with prefabricated, modular, and inflatable structures. Main coverage applies to prefabricated buildings, modular construction, modular structures, prefabricated modular building units, expandable structures, space stations, shelters, tents, textiles, honeycomb cores, sandwich construction, antennas, structural parts, and materials for polar regions and mobility. Attention is given also to simulations, tests, and feasibility studies. Author and subject indexes are included. The reports cited in this bibliography are available from NTIS.

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## **TECHNICAL OPTIONS FOR ENERGY CONSERVATION IN BUILDINGS**

National Bureau of Standards, Building Environment Division.  
July 1973. 184 pages.

**COM-73-50628**

The purpose of the report is to provide reference material on technical options for conserving energy in buildings. Both existing buildings and new buildings are considered. For existing ones, principal topics are summer cooling, winter heating, insulation, fenestration, lighting, appliances, domestic hot water, and human comfort—the last item being particularly difficult to deal with. Actions include those accomplishable voluntarily or without expense, and those requiring some measure of effort or expense to the building owner or occupant. For new buildings, the considerations involve building design and mechanical systems. A summary of mechanisms for implementation is made, with some criteria for evaluating them. One major consideration in all categories is the elimination of wasted fossil fuels and electricity, by use of appliances only when necessary, and the reduction of operating levels.

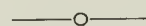
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## **DURABILITY AND MAINTENANCE AS RELATED TO THE SELECTION OF FLOORING**

National Bureau of Standards, Center for Building Technology.  
W. C. Wolfe, R. E. Roberts and M. Russell. August 1973. 68  
pages.

### **COM-73-50684**

Flooring plays an important part in building economics. Its care is a large item in maintenance costs. It receives most of the wear from human activities; it contributes to building appearance and so must be considered in interior design; it contributes to the factors of comfort, fatigue, and noise; there are special problems of slipperiness, indentation, static charge, and cleaning; and new products frequently are introduced to replace standard flooring, carpeting in particular. The report is addressed to selection and maintenance of flooring to the best advantage in terms of durability, type and severity of service, appearance, comfort, and safety. Selection is discussed with respect to service life, maintenance, obsolescence, and trade-off considerations. Field observations and preliminary field tests are noted that indicate areas in which research is needed.

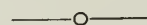


## **STRUCTURAL DEFLECTIONS. A LITERATURE AND STATE-OF-THE-ART SURVEY**

National Bureau of Standards, Center for Building Technology.  
T. V. Galambos, P. L. Gould, et al. October 1973. 103 pages.

### **COM-73-50975**

This report provides a review of the literature and the state-of-the-art on the deflections of building structures. For static deflections information is given on effects, limitations, computations, and field observations. The rest of the coverage is on dynamics. Some of the topic headings are design practice, forcing functions, structural systems, natural frequency and damping, damage, vibration isolation; floor vibrations; drift loading, limitations, calculations, and measurements; and human response including physiological, subjective, and observed characteristics. Emphasis is placed on serviceability limit states of deflections. An effort is made to identify serviceability criteria for the present practice of building construction, to determine the theoretical and experimental basis for these requirements, and to evaluate the range of applicability of existing criteria. A bibliography of 233 references is included.



## **CHARACTERISTICS OF LOAD-BEARING SANDWICH PANELS FOR HOUSING: STATE-OF-THE-ART REPORT**

Department of Agriculture, Forest Products Laboratory. 1973.  
211 pages.

## **PB-222 440**

Efficient use of materials can be enhanced by employing composites, which achieve certain advantages not available from single materials. Modern durable adhesives make possible structural forms of thin, dense facings upon thick, lightweight cores, providing desired mechanical characteristics while using minimum amounts of material. Such a structural sandwich compares with an I-beam, the facings of which carry direct and tension loads, and the core carrying shear loads. For good thermal insulation, the sandwich core is usually of low density material or some type of cellular or honeycomb sheeting. Because sandwich facings are thin, consideration must be given to prevent wrinkling. The state-of-the-art report is concerned with the proper design and application of sandwich panels for housing. Information is included on fire safety, acoustic properties, dimensional stability, thermal environment, durability, and fabrication quality control. Rigorous design procedures are discussed, and formulas are given where possible. Summaries are made of testing procedures for evaluating panel performance. Consideration is also given to stresses, bonding, micro-biological and chemical resistance, loading, joints, and supports.

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**Building  
Technology  
& Structural  
Engineering  
(continued)**

## **LIGHTWEIGHT CASTABLE MATERIALS FOR HOUSING MODULES**

Dow Chemical Co. H. S. Smith, and S. J. Waling. October 1971. 189 pages.

## **PB-222 674**

The industrialized production of three dimensional modular housing promises to contribute to efforts to fulfill the housing requirements of the future. The technique of casting or molding modules is well suited to industrialization. A lightweight (50-70 pounds per cubic foot), castable, fire-resistant material has now been developed for this purpose. In comparison to conventional lightweight concrete, the new material has the following advantages: Ease of plant handling, transport, and erection of a module; increased thermal insulation; increased marketing radius for a given production facility; increased fire resistance; and practicality of larger modular units. The material is basically a portland cement/water system that uses expanded ceramic aggregate as the dominant aggregate. Silica fines and polyvinylidene chloride microspheres as companion aggregates permit low density to be achieved while maintaining sufficient structural properties. Methyl cellulose polyvinylidene chloride latex are modifiers that provide processing advantages that may be required for modular applications. This document covers material selection and test results, structural analysis of castings, and an economic evaluation.

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## **A STUDY OF TECHNIQUES TO INCREASE THE SOUND INSULATION OF BUILDING ELEMENTS**

Wyle Laboratories. Ben H. Sharp. June 1973. 227 pages.

**PB-222 829**

One of the many environmental characteristics that must be considered in building technology is the sound insulation provided by the various building elements. This report presents research on techniques that increase the sound insulation of building elements and also lower the cost. Acoustic principles are discussed that form a comprehensive basis for the design of sound attenuating structures using single- or multiple-panel constructions. A series of expressions are derived with which the transmission loss of many types of constructions can be determined. It is shown how given mathematical expressions may be used to arrive at optimum designs for specific sound insulation requirements. The study develops practical prototype constructions, which are superior to present constructions in common use.

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## **SETTLEMENT PREDICTION: A PROBABILISTIC APPROACH**

Massachusetts Institute of Technology, Department of Civil Engineering. Jorge Diaz-Padilla, and Erik H. Vanmarcke. August 1973. 83 pages.

**PB-225 047**

In the past, foundation engineering and superstructure engineering have not required extensive intercommunication, but as building codes and design economy have received increasing attention, the two domains can no longer remain apart. In considering overall performance and structural safety their interaction must be accounted for, with the ultimate goal of design optimization—maximization of utility and minimization of expected costs—and determination of potential damage costs as well as costs of exploration and soil sampling. The report notes that any approach requires systematic analysis of the uncertainties, and it becomes increasingly necessary to substitute quantitative analysis of variability, risks, and decisions for assessment by judgment. A probabilistic soil structure interaction model is developed to yield information about the possible movements of the foundation with regard to loads and soil properties, although it is applicable only to linear elastic structures supported on shallow foundations. Bounds are suggested for differential settlement where stiffness deterioration occurs. Forces imposed on a structure by random deformation of its foundation are also discussed. The model leads to a mathematical prediction of structure settlement.

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## **A STRUCTURAL DESIGN PROCESS: PHILOSOPHY AND METHODOLOGY**

University of California (Berkeley), Structural Engineering Laboratory. James M. Becker. September 1973. 262 pages.

**PB-225 086**

A philosophic inquiry is made into the process by which the structural engineer determines how resources may be converted into functional systems. As analytical techniques continue to advance, and materials become more numerous and complex in behavior, the increased and expanding body of information makes optimized design difficult. Structural design is examined with the view of developing a deeper understanding. A mathematical model is developed, from which a primitive information control system is reached. A multilevel interactive process guides the designer through defining desired attributes, determining evaluation methodology, and obtaining needed design descriptors. This system, termed MAGID, the manipulation and generation of information for design, recouples the relevant subspaces and presents the designer with an ordered set of acceptable design kernels. A sample problem is presented by which computer technology develops an alternate structural system for a multistory apartment building. Primary factors are materials, particularly steel, minimum geometric changes, minimum on-site labor cost, and mechanical properties. Contextual factors include wind forces and seismic characteristics of the region.

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Building  
Technology  
& Structural  
Engineering  
(continued)

## **AN ECONOMY MODEL FOR GENERATING, EVALUATING, AND SELECTING ARCHITECTURAL DESIGN ALTERNATIVES**

Carnegie-Mellon University, Institute of Physical Planning. Volker Hartkopf. February 1973. 14 pages.

**PB-225 469**

Architectural design can be regarded as a means of putting the explicit needs of clients and users into physical form, arrived at by evaluating the various alternatives possible and making a decision. Such evaluation must be achieved early in the process. A case study is described that exemplifies a method using economic analysis to generate and evaluate the design alternatives. Included maintenance, operation such as wages and machinery costs, and are initial and future investments necessary for construction, confidence limits for which certain alternatives provide best values. The effect of various economic environments is tested using sensibility analysis. Implications of environment design are discussed.

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# **CHEMICALS & CHEMICAL PROCESSING**

## **REVERSE OSMOSIS BIBLIOGRAPHY: ABSTRACTED AND INDEXED**

Plastics Technical Evaluation Center. Joan B. Titus. June 1973. 182 pages.

### **AD-769 208**

Reverse osmosis has become, in recent years, an important commercial solution separation process. Some of the current applications are: Concentration of food products such as fruit juices, coffee, tea, syrups, sugar, and whey; desalination and/or demineralization of water supplies; chemical processing operations such as fractionation, catalyst recovery, gaseous separations; medical uses such as virus concentrations, pyrogen-free water, dialyzate and ophthalmic solutions, and the like; treatment of sewage and industrial wastes, including the recovery of valuable solutes. This document is intended to provide access to information on reverse osmosis and related hyperfiltration and ultrafiltration technology. The 669 items cited originally appeared during the years 1967-72. Abstracts are provided for most of the items. Author and subject indexes are included, as is a glossary of terms.

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## **ACTINIDE PROPERTIES AND METHODS OF PRODUCTION**

E. I. Du Pont De Nemours and Co., Savannah River Laboratory. R. G. Baxter. December 1972. 95 pages.

### **DP-1269**

With the growth of the nuclear power industry and specialized radioisotope production programs, large amounts of actinide radioisotopes are being produced by nuclear reactors and smaller amounts are being produced by nuclear accelerators. This document surveys the principal methods of actinide production and separation, and outlines their properties and uses. The nucleides discussed are of special interest in industrial or scientific fields; have found practical industrial application; are useful for characterizing chemical, physical, and metallurgical properties of elements; or have interesting nuclear properties. A bibliography of basic literature sources is included.

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**THE CHEMISTRY OF GYPSUM AND ITS DEHYDRATION PRODUCTS. VOL. 2, THE PHYSICOCHEMICAL AND MECHANICAL PROPERTIES OF THE PHASES. PART 1, GENERAL REFERENCES.**

**PART 2, THERMODYNAMICS**

Stanley Evan Edinger. June 1973. 222 pages.

**PB-221 241**

This document is part of a multivolume work that is intended to provide a comprehensive coverage of the international literature, dating from antiquity to the present, on gypsum and its dehydration products. More than 270 abstracts from the worldwide literature are contained in the document. The citations pertain to general reference works on the physicochemical and mechanical properties of the various calcium sulfate phases, and on the thermodynamic properties of this important mineral and building material. For previous documents in this series see PB-203 308 in AMTID, April 1972, page 11; PB-208 280 in AMTID, October 1972, page 6; and PB-211 207 in AMTID, January 1973, page 7.

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**RECOVERY OF MERCURY FROM CINNABAR ORES BY ELECTROOXIDATION**

Bureau of Mines, Reno Metallurgy Research Center. Bernard J. Scheiner, R. E. Lindstrom, and D. E. Shanks. 1973. 17 pages.

**PB-221 900**

Mercury, an element important to industry in both the combined and uncombined forms, has usually been recovered by roasting its principal ore cinnabar (red mercuric sulfide) and condensing the vapors to obtain the metal. Disadvantages have consisted of some mechanical and chemical losses, considerable air pollution, and certain hazards to plant employees. Consequently, other technology has been sought, including a hydrometallurgical approach discussed in the report. An electrolytic method is described, based on an electrooxidation process originally developed in connection with gold ores. Slurries made from ore, sodium chloride, and water were tested in the laboratory at constant temperature, with electrodes inserted to determined depth, and direct current passed through at a desired amperage. Ionic theory is presented, the chemical reactions involved are given, and the mercury is observed as carried into solution as a stable tetrachloride complex. Yield is reported for 62 different mercury ores as 90 to 99% mercury treatment time is observed, and the power consumption is shown. The recovery of metallic mercury by precipitation and vaporization is outlined. The various benefits to be expected from this methodology are noted, and indications are made for developments.

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## EXTRACTION OF MOLYBDENUM AND RHENIUM CONCENTRATES BY ELECTROOXIDATION

Bureau of Mines, Reno Metallurgy Research Center. R. E. Lindstrom, and B. J. Scheiner. 1973. 15 pages.

### **PB-225 345**

Molybdenum and rhenium are usually recovered from porphyry copper ores classical flotation techniques. Copper and molybdenum are separated by subsequent flotation steps, and rhenium is recovered in a roasting sequence. Overall recovery of molybdenum usually approaches 50–60%, and 30–40% of the rhenium is recovered. This document describes a new electrooxidation process for the recovery of molybdenum and rhenium from low-grade concentrates in which the rhenium values are significant. The extraction of 98–99% molybdenum and rhenium is feasible by the new technique, with a power consumption as low as 9.7 kWh per pound of molybdenum extracted. Parameters affecting the extraction, such as pulp density, power consumption, reagent requirements for pH control, and electrolytic cell configuration, are discussed. Optimum extraction conditions are outlined.

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# **CIVIL ENGINEERING**

## **THICK WALLED MULTIPLE OPENING REINFORCED CONCRETE CONDUITS**

University of Illinois, Structural Research Laboratory. M. O. Ryan, M. H. Salem, W. L. Gamble, and B. Mohraz. December 1972. 197 pages.

### **AD-766 813**

Information has been needed for the rational design of conduits or box culverts suitable for use under earth dams or other embankments with fill heights up to about 250 feet. Current design guides have led to structures with a member thickness considerably greater than might be necessary. The report describes the construction and testing of three closed three-span reinforced concrete frames representing slices of reinforced concrete conduits designed for loads up to 30,000 psf. The tests appear to be the first complete frame investigations, and their results indicate that the shear strength of such members may be considerably less than for simply supported members with similar geometry and loading. Development of analytical techniques, using a fine element method to predict structural behavior, is discussed. The analysis includes cracking properties, nonlinear stress-strain characteristics, and reinforcement yielding. Results of an elastic analysis of one model structure is presented, and some recommendations are made.

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## **SEISMIC REFRACTION EXPLORATIONS FOR ENGINEERING SITE INVESTIGATIONS**

Army Engineer Waterways Experiment Station, Explosive Excavation Research Laboratory. Bruce B. Redpath. August 1973. 60 pages.

### **AD-768 710**

Refraction seismic surveying was once used extensively in the exploration for oil bearing geologic structures. Although its application in the oil industry has diminished over the years, the method is increasingly used for site investigations for civil engineering. This document is intended as a guide to the application of seismic refraction techniques to shallow, subsurface exploration of engineering sites. The primary purpose is to provide a working



knowledge of the method, a convenient reference, and a basis to judge the applicability of the method and the results to particular exploration problems. The fundamentals of seismic refraction theory are discussed, and consideration given time-intercept calculations, the critical distance method for determining depth, the effect of dipping layers on depth calculations, and interpretations using delay times. Some of the problems and limitations involved with the use of this exploration tool are discussed, and other applications of the equipment are described. Field procedures for carrying out refraction surveys are recommended.

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### **THE EFFECT OF MATERIAL PROPERTIES ON MATERIALS HANDLING PROCESSES**

University of Wisconsin, Engineering Experiment Station. B. C. Mehta, D. Patel, et al. October 1973. 55 pages.

#### **AD-771 272**

The development of large diameter tunneling machines has provided a new era in hard rock tunneling practice, and new designs of increasing capacity are constantly being sought, fabricated, and tested. The problems of handling materials in a rapid excavation process are enormous, particularly since tunneling no longer is bound by the constraints imposed by the cyclic drill-blast method. The volume of rock fragments produced by continuous excavating machines is largely a function of the speed of the cutting head and the thrust on it, whereas the particle shape and size depend both on the type of cutter and the relative strength of the material being attacked. A study has been undertaken to attempt to identify the variables controlling the handling processes. To aid in the study a model belt conveyor system and simulator was developed. Its design, modifications, and problems are discussed. This report describes the experimental investigation program, including general considerations, belt conveyor system variables, design of the test belt system, results of the tests conducted, and some conclusions.

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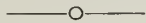
### **PREDICTIONS OF GEOLOGIC AND HYDROLOGIC CONDITIONS AHEAD OF RAPID EXCAVATION OPERATIONS BY INHOLE GEOPHYSICAL TECHNIQUES**

Bureau of Mines, Denver Mining Research Center. James H. Scott, and Joe Sena. November 1973. 36 pages.

#### **AD-771 689**

Unknown or poorly defined geologic and hydrologic conditions are the principle factors involved in the degree of difficulty in rapid rock excavation, and the total costs of excavating and sup-

porting underground openings by rapid methods. Now methodology is needed to characterize these properties ahead of tunneling and mining operations. Geophysical well logging is seen as providing the most accurate and detailed information possible in present technology prior to actual tunneling. Inhole measurements offer a means of greatly increasing the amount of data from drill holes. This report provides the results of a research program in which an inhole geophysical measurement system was developed and tested. Computer techniques were also developed for synthesizing and plotting logs of mechanical characteristics including fracture.

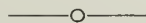


## **STRUCTURAL PERFORMANCE OF DRAINAGE STRUCTURES**

National Academy of Sciences, Highway Research Board. 1973. 56 pages.

### **PB-222 875**

Advances in transportation engineering have prompted considerable research on the structural design of pipelines and culverts, although such conduits are important to other types of facilities. The document contains discussions of the long-time measurement of loads on pipe culverts, induced-trench methods of culvert installation, an investigation of soil-structure interactions of buried concrete pipe, and the computerized design of precast reinforced concrete box culverts. The publication is not a design manual, but it contains timely insights into a wide spectrum and designs and installation methods.



## **CUT-AND-COVER TUNNELING TECHNIQUES. VOL. 1: A STUDY OF THE STATE-OF-THE-ART**

Sverdrup and Parcel and Assoc. Inc. February 1973. 246 pages.

### **PB-222 997**

Cut-and-cover tunneling is a process of excavating an area of desired depth and width, constructing a permanent tunnel structure at the bottom of the excavation, and covering the structure with soil. The excavation may be left temporarily open or recovered with temporary decking if the construction is in a street. A two-volume report is made on a study of cut-and-cover tunneling techniques specifically related to urban areas in both the United States and abroad. The object was to define factors that cause interference with surface traffic and that disrupt businesses and communities, and to determine some recommendations for minimizing these factors. Chapter topics in the first volume include: Environmental quality considerations; geotechnical investigation and analysis; ground water control; ground wall support; conventional, pneumatic, and hydraulic conveying and excavation methods; structural control such as underpinning, street decking, and re-

location or support of utilities; structural forms including cast in place concrete; precast concrete elements; slurry walls; continuous bored or secant piles; caissons; under-roof construction; waterproofing; and space utilization above the tunnel. Other topics include restoration methods, cost considerations, major problems encountered, and recommendations for further consideration.

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## **CUT-AND-COVER TUNNELING TECHNIQUES. VOL. 2: APPENDIX**

Sverdrup and Parcel and Assoc., Inc. February 1973. 179 pages.

### **PB-222 998**

This, the second volume of a two-volume report on cut-and-cover tunneling, presents some general considerations to supplement the materials of Vol. 1, and discusses in some detail such factors as braced excavations, chemical injection and grouting, dewatering, freezing, qualities of permanent structures, sheet-pile walls, and tiebacks. A discussion is provided of operations in soft ground; lateral movements of vertical earth supports; cohesionless sand; cohesive granular soil; medium and other clays; settlement caused by removing struts; base failure by heave; braced trenches; dredging; air pressure; and earth pressure.

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## **THE BEHAVIOR OF STATISTICALLY HETEROGENEOUS EXCAVATED EARTH SLOPES**

Auburn University, Department of Civil Engineering. L. M. Kraft, Jr., and J. Mukhopadhyay. December 1972. 215 pages.

### **PB-224 916**

The soil engineer is faced with a difficult task in selecting a soil property for use in an analysis owing to a number of uncertainties involved. One of these is the uncertainty of the effects of statistical spatial variations of soil and of limited sampling on the performance of an earth structure. This document presents probability models for describing the spatial variations of soil properties, and quantifies the performance of excavated earth slopes by evaluating the deformation mode of statistically heterogeneous soil masses. The variational nature of soil properties is described, along with analytical models. The simulation of the construction of an excavated slope and the spatial variation in soil properties is discussed, and results of applications of the models are presented. This work should assist soil engineers in establishing the number of samples required for a given job, and the safety factor for a requisite reliability.

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## **THE BEHAVIOR OF AXIALLY LOADED DRILLED SHAFTS IN SAND**

Civil Engineering  
(continued)

University of Texas, Center for Highway Research. Fadlo T. Touma, and Lymon C. Reese. December 1972. 275 pages.

### **PB-224 976**

The art and the practice of deep foundation engineering have consistently progressed at a rate that has left the supporting scientific theories far behind. Drilled shafts (also called "drilled piers", "drilled caissons", and "bored piles") are one manifestation of this situation. The application of modern drilling equipment to the construction of drilled shafts has not only revolutionized the methods of construction of these shafts, but has also made them competitive with other types of foundations. However, a better understanding of the behavior of drilled shafts constructed by these methods is needed to make a better use of these shafts and bring more confidence in their design. This report provides the result of an investigation of the behavior of drilled shafts in sand, and a comparative evaluation of the dry construction procedure versus the slurry displacement procedure. A method is presented for the design of drilled shafts in sand that is believed to be safer and more economical than existing methods for shafts penetrating no more than 25 feet. It is also shown that the slurry displacement technique can be used successfully in the construction of drilled shafts in caving soils.

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## **WIDTH CONSTRICTION IN OPEN CHANNELS**

Colorado State University, Agricultural Engineering Department. J. W. Hugh Barrett. November 1972. 109 pages.

### **PB-225 553**

The hydraulics of bridge construction involves determining the backwater caused by placing a bridge across a stream of known discharge, or determining the discharge through a constriction having some measure of the backwater owing to the construction. This report compares existing methods of calculating the backwater caused by, or discharge through, a constriction in an open channel, and shows how these methods are but particular expressions of a more general submerged-flow equation. Velocity equations are presented, involving construction discharge, pier coefficient, contraction ratio, channel configuration, Froude number, and backwater ratio. The submerged-flow analysis is studied in detail, and much of the information is given in graphic form. Some model studies are described, and a check on the constancy of discharge coefficients is discussed. Recommendations are made for experimental flume work.

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## FACTORS IN SELECTING AND APPLYING COMMERCIAL EXPLOSIVES AND BLASTING AGENTS

Bureau of Mines. Richard A. Dick. 1968. 36 pages.

**PB-225 589**

In spite of an abundance of information on blasting techniques, the user may have difficulty in evaluating commercial explosives; the literature is cluttered with data on uncommon compounds and chemical properties that are of little value to drilling and blasting personnel. The man in the field may often wonder if he has chosen the proper explosives for his purposes. The report is intended to help the user become more familiar with the explosives available to him. Commercial blasting compounds are classified according to their nitroglycerin or explosive oil and ammonium nitrate content as dynamites, gelatins, blasting agents, military explosives, and blasting accessories. Ingredients and significant properties of each explosive are tabulated and briefly discussed. Properties discussed include weight strength, cartridge strength, detonation velocity, density, detonation pressure, water resistance, and fume class.

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# COMPUTERS

## ENGINEERING DESIGN HANDBOOK: COMPUTER-AIDED DESIGN OF MECHANICAL SYSTEMS

Army Materiel Command. Edward J. Haug, Jr. July 1973.

**AD-767 826**

The Handbook is one of a coordinated series containing information basic to the design and development of materiel and systems. It treats a broad class of optimal design problems suitable for computer application. A steepest descent approach is used, structured so that it can be understood and used by practicing engineers with a good background in calculus and matrix theory. Elements of computer aided design are discussed; cost functions are analyzed by several methods; linear programming is explained; nonlinear programming is applied to finite dimensional optimal design; finite dimensional optimal structures such as beams and columns are discussed; optimal design by the indirect method is outlined for structures such as towers and beams; and steepest descent methods are applied to optimal structural design. The treatment is highly mathematical, but should be of value in the engineer's library.

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## ANNOTATED BIBLIOGRAPHY OF THE LITERATURE ON RESOURCE SHARING COMPUTER NETWORKS

National Bureau of Standards, Information Processing Technology Division. R. P. Blanc, I. W. Cotton, et al. September 1973. 97 pages.

**COM-73-50750**

This bibliography is comprised of references to and abstracts of the literature concerning computer networks consisting of independent computer systems that communicate with one another and share resources such as hardware, programs, or data. The types of references included may be grouped into the following categories: General, introductory, survey, or tutorial; analyses, simulations, algorithms, and theoretical formulations; design of networks and components, and implementation issues; uses of computer networks; management and operation of networks. Indexes are included.

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# CONCRETE

## DURABILITY OF CEMENT CONCRETE IN SULFATE ENVIRONMENT

University of California (Berkeley), Department of Civil Engineering. P. K. Mehta, and R. B. Williamson. September 1973. 25 pages.

### AD-767 312

Portland cement concrete structures vary considerably in their resistance to attack by sulfate ion in sea water. This document provides a review of the problem, and gives a new laboratory test method for evaluating the sulfate resistance of cements. The new technique is quick and simple, and appears to be capable of evaluating the chemical resistance of cementitious materials to attack by sulfate solutions usually occurring in nature.

## CONCRETE-POLYMER MATERIALS FOR HIGHWAY APPLICATIONS. PROGRESS REPORT NO. 2

Brookhaven National Laboratory. L. E. Kukacka, A. J. Romano, et al. April 1972. 173 pages.

### PB-22 119

Much work has been done in recent years showing the greatly increased strengths and durabilities of concretes after impregnation and subsequent polymerization of monomers in concrete. This report provides the results of an ongoing investigation of the applicability and practicability of this type of concrete in highway applications. The effects of aggregate composition and size on the structural properties of concrete impregnated with polymethyl methacrylate are described. It is shown that great improvements in the strength may be had by impregnating concrete that is already hardened with monomethyl methacrylate and polymerizing in situ. Underwater polymerization appears to be an effective and practical method of encapsulation for use with large precast concrete sections. Preliminary design studies indicate that lightweight, durable bridge decks of precast concrete-polymer material can be produced. Techniques for producing high-strength, durable polymer impregnated concrete from lightweight insulating-type concretes were developed and based on the fabrication of prototype

lampposts and pipes, this material seems suitable for structural applications. The feasibility of repairing deteriorated bridge decks by partial impregnation and in situ polymerization was demonstrated.

Concrete  
(continued)

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## GRADING OF CONCRETE AGGREGATES

National Academy of Sciences, Highway Research Board. G. Lees, Shu-t'ien Li, et al. 1973. 132 pages.

### B-223 004

Mineral aggregates constitute roughly 75% of the absolute volume of concrete, and substantial investment is made annually to ensure that this important constituent has suitable grading for particle size and composition. Challenges to accepted practice in grading are periodically made, and the 10 papers of the report are aimed at updating the knowledge of such practices. Subject topics are: Rational design of continuous and intermittent aggregate gradings; gap-graded aggregates for high strength quality; effect of maximum size of coarse aggregate on D-cracking in pavements; influence of aggregate grading on mix proportions; aggregate grading and the internal structure of concrete; methods for determining blending proportions; compatible gradation and optimum void-filling concrete proportioning for full consolidation; grading effect on lean-mix concrete; effect of variations in coarse-aggregate gradation on portland cement concrete properties; and review of aggregate blending techniques.

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## POLYMER IMPREGNATED CONCRETE AS A STRUCTURAL MATERIAL

Lehigh University, Fritz Engineering Laboratory. Einar Dahl-Jorgensen, and Wai-Fah Chen. May 1973. 20 pages.

### PB-224 946

Concrete impregnated with a monomer such as methyl methacrylate followed by in situ polymerization (Polymer Impregnated Concrete or PIC) has proved to have three- to fourfold improvement in strength as compared to that of ordinary concrete. PIC also has an increased modulus of elasticity; resistance to water penetration, abrasion, and chemical attack; improved freeze-thaw resistance; negligible creep; and reduced weight-to-strength ratio. One of the primary deterrents to the use of PIC in building construction, however, is its brittle behavior. It is shown in this document that the brittleness can be reduced in PIC impregnated with methyl methacrylate when this monomer is used in various combinations with butyl acrylate. The higher the percentage of butyl acrylate, the larger the ductility; however there is a corollary decrease in strength and modulus of elasticity. A PIC material may thus be prepared to fit any specified criteria concerning

strength versus ductility and thereby providing potentially tailored material properties to fit a particular service requirement as a structural material. The method of impregnation and polymerization is also described in the document.

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### **MATERIAL AND STRENGTH CHARACTERISTICS OF CONCRETE MIXTURES BY ACOUSTIC SPECTRA ANALYSIS**

University of Akron, Department of Civil Engineering. Demeter G. Fertis. February 1971. 253 pages.

#### **PB-225 426**

A new approach and method is described by which important material properties and strength characteristics of concrete can be determined. The method is referred to as the method of acoustic spectra analysis. It is based on the principle that when a concrete cylinder is gradually loaded to its ultimate capacity, the resulting total energy is also gradually stored in the cylinder. At failure, this energy is suddenly released and sound intensities of various magnitudes are produced. The pattern and intensities of such sounds depend upon the amount of energy released, and thus upon the material properties and strength characteristics of the mixture used to prepare the concrete cylinder. Such properties, since the stored energy is suddenly released, include both static and dynamic material behavior. The method makes it possible to determine such important properties as fatigue strength, fatigue life, and quality of concrete mixtures; effects of random loading on fatigue and general behavior of concrete; as well as other properties and characteristics.

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# **EARTHQUAKE ENGINEERING**

## **CONTRIBUTIONS TO SEISMIC ZONING**

National Oceanic and Atmospheric Administration, Environmental Research Laboratory. Samuel T. Harding (Ed.). May 1973. 101 pages.

### **COM-73-50828**

Earthquake zone maps suitable for engineering have presented a difficult problem, since quantitative mapping requires data on earthquake focal mechanisms, wave attenuation, and site amplification in addition to earthquake distributions through time and space. This seven-report document presents a new approach to seismic zoning and examines some of the important factors involved. The first paper develops a probabilistic mapping technique requiring input as noted above, plus relations between ground shaking and geological hazards, and anticipated response to ground motion. The second discusses significant bias which results from ignoring temporally inhomogeneous seismicity data. The third paper covers the importance of accurate hypocenter locations and earthquake focal mechanisms, presenting examples of the kind of investigations that are needed. Fifth is a comparison of far field aftershock technique with physical transfer function models and the dynamic finite element technique in analyzing ground motion in the San Fernando, California, main shock. Next is a summarization of aftershock results in the 1967 earthquake at Caracas, Venezuela. Following this is an illustration of considering the dynamic capacity of classes of structures. The final report makes economic loss predictions involving the San Andreas and Hayward fault (California), with particular attention to dwellings as the result of shaking damage.

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## **BUILDING PERFORMANCE IN THE 1972 MANAGUA EARTHQUAKE**

National Bureau of Standards, Center for Building Technology. Richard N. Wright, and Samuel Kramer. November 1973. 157 pages.

### **COM-73-50971**

The December 1972 earthquake at Managua, Nicaragua, has been estimated at only 6.25 Richter magnitude but loss of life ap-

proached 10,000; three quarters of the city's 450,000 population were made homeless, and property damages came near to a billion dollars. Field investigations to determine is surviving buildings were usable, repairable, or hazards, and to identify needs for improvement in building practices are reported. The major damages appear not attributable to high intensity ground shaking or severe geologic faulting but to deficiencies in structural design, regulation, and construction. These inadequacies in an earthquake-likely environment were already well known, but appropriate building codes were not being enforced. The Managuan experience should move other areas subject to substantial earthquake risk and that have not consistently accounted for these risks in their codes to rectify matters. Detailed reports are made on structures and components, accompanied by numerous photographs of damage severity or inseverity.

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### **EARTHQUAKE ANALYSIS OF MULTISTORY BUILDINGS INCLUDING FOUNDATION INTERACTION**

University of California, Earthquake Engineering Research Center. Anil K. Chopra, and Jorge A. Gutierrez. June 1973. 47 pages.

#### **PB-222 970**

It is known that the response of structures to earthquake ground motion is influenced by the deformability of the foundation. It is therefore desirable to develop efficient methods of analysis so that structure-foundation response can be determined and the effects of the interaction can be studied. The report presents a satisfactory method for dynamic analysis of the earthquake response of multistory buildings. In the first of two methods discussed structural displacements are transformed to normal modes of vibration of the building on a rigid foundation. In a second method, based on the Ritz concept, the structural displacements including those at the base are expressed as a linear combination of vectors. Both methods are much more efficient than direct ones, the first appearing preferable.

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### **OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK: 1973 CONTRIBUTIONS**

University of California, Water Resources Center. C. M. Duke, and S. E. Jacobsen. June 1973. 115 pages.

#### **PB-223 359**

A major problem for planners of water systems is how to account for earthquake risk in designing a water system. For example, a particular segment of aqueduct or pipeline may incur damage be-

cause the seismic intensity exceeds what the segment was designed to withstand, or because repeated earthquakes occur during a single period. The first of three reports in the document presents a renewal theoretic model to evaluate expected damage costs for a segment in a large seismic region. The second describes how earthquake occurrence can be expressed in terms of distributions in space, size, and time. Combining these distributions with site and intensity functions leads to establishing the probability of each level of intensity at any site. The method is seen as applicable for decisions on optimizing the routing of aqueducts or other systems extending over large areas. The third report discusses an attenuation formula derived for the Arias instrumental intensity on bedrock, including a source spectrum function. Constants in the formula were calibrated for the 1971 San Fernando earthquake, using eight bedrock spectra derived from surface accelerograms. Surface attenuation curves were obtained for four types of bedrock, providing intensity data for zoning purposes. The findings are expected to be valuable in various types of earthquake engineering.

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**Earthquake  
Engineering**  
(continued)



# **ECONOMICS OF DEVELOPMENT**

## **A STUDY OF INDUSTRIALIZATION IN COLOMBIA: PART 1, ANALYSIS**

Rand Corp. Richard R. Nelson. December 1967. 86 pages.

**AD-663 407**

The report describes certain characteristics of Colombian manufacturing industry that have caused problems for a developing country, and it attempts to identify factors that explain these characteristics or constrain the achievement of better performance. Three key characteristics are discussed: low productivity levels, an economic structure heavy on consumer goods industries but light on intermediate and capital goods, and relatively small size in this sector. The size, together with wages significantly higher in manufacturing than in agriculture, have stimulated rural to urban migration, so that rapid industrial growth must occur to avert rising urban unemployment. A preliminary examination is made of the interaction of two constraints: foreign exchange, and domestic savings. Some mathematical models are developed. The analysis indicates that increasing domestic savings may cause unemployment to increase because of reduced consumer goods activity, but that increase in foreign exchange would permit the modern sector of Colombian manufacturing industry to be expanded without high unemployment.

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## **URBAN UNEMPLOYMENT IN COLOMBIA: MEASUREMENT, CHARACTERISTICS, AND POLICY PROBLEMS**

Rand Corp. Robert L. Slighton. January 1968. 75 pages.

**AD-664 880**

Unemployment has been a major economic problem in Colombia, presenting also a potentially critical political problem. Thus, in an economic survey, it is important to observe the dimensions and characteristics of Colombian unemployment. Many facets to the labor situation need study, such as the determinants of internal migration, employment management relations to technology and to new investments, competition in the labor market relative to competition in the output market, and the labor consequences of

import substitution, export increase, and allied factors. An analysis is made of Colombia's urban unemployment in 1968, noting that about 10-16% of the labor force in the larger cities was then unemployed, with the percentage increasing. The report discusses the implications of such a trend, and shows the need for altering the rate and pattern of industrial output if a developing country is to better its economic situations.

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### **RELATIVE WAGES, SKILL SHORTAGES, AND CHANGES IN INCOME DISTRIBUTION IN COLOMBIA**

Rand Corp. Robert L. Slighon. November 1968. 75 pages.

**AD-678 728**

Estimating the achievements of a foreign assistance program involves the measurement of changes in the incomes of the inhabitants of the recipient country, whatever the aims, terms, or interests may be. The distribution of income in Colombia in 1968 was very unequal; ten percent of the population in the larger cities received about half of the total personal income. An increased inequality resulted from the combined effects of unemployment increase and increase in wage differentials between the nonagricultural subsectors. The report examines the hypothesis that income inequalities will widen if growth in the modern sector of the economy is retarded in transition from agrarianism to a dual economy. A discussion is provided of the effect of worker educational levels, the availability or scarcity of occupational skills, and competition characteristics in the labor market. It is noted that the patterns of income distributions may change if population growth is controlled, if export and import capabilities are developed, and if labor force quality is upgraded.

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### **THE EFFECTIVE EXCHANGE RATE, EMPLOYMENT, AND GROWTH IN A FOREIGN EXCHANGE CONSTRAINED ECONOMY**

Rand Corp. Richard R. Nelson. November 1968. 65 pages.

**AD-678 891**

This document is concerned with the influence of the exchange rate on Colombia's ability to achieve growth and employment objectives. It begins by examining two-gap models that may lead to pessimistic conclusions, such as an inability to progress without increases in foreign assistance, or an inability to deal with a massive unemployment. An alternative model is developed that admits the possibility of substituting domestic input for imports, and makes possible a reconsideration of employment problems. An analysis is given of how the price of foreign exchange relative to domestic factor prices can influence the balance of Colombia payments and thereby effect faster growth and higher employment.

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## POPULATION GROWTH AND INTERNAL MIGRATION IN COLOMBIA

Rand Corp. T. Paul Schultz. July 1969. 114 pages.

### AD-691 714

Rapid growth of population in low-income countries is a poorly understood part of the development problem facing these nations today. A second feature of concern is the process of internal migration, which concentrates population more and more about the cities. The report covers a study of demography and population movement in Colombia. Economic causes, policies, and consequences are discussed in considerable detail. The first part deals with the determinants of fertility, a hypothesis of birth frequency and constraints as related to environmental characteristics and interregional differences, and the impact of urbanization and rising incomes on birth rates. The second part estimates and analyzes Colombian migration between 1951 and 1964. For example, about one third of the rural population under age 40 in 1951 were observed by census count to have left the rural scene by 1964. A model of interregional migration is developed and estimated within the limits of Colombian data. Following a regression analysis, a summary is presented and some conclusions are drawn. Unemployment relations are also noted.

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## INDONESIAN ECONOMIC ISSUES AND OPTIONS

Rand Corp. C. Wolf, Jr., J. Koehler, and A. Williams. August 1972. 80 pages.

### AD-766 859

The report has two objectives: to examine a set of major economic issues and policy choices that Indonesia faces; and to consider some of the options open to assistance programs and policies. Where possible, an effort is made to link the two objectives. The following factors are considered: public sector development budget and aid counterpart, credit policy and interest rates, foreign investments, agriculture, and marketing characteristics. For each issue the present policies followed by the Indonesian government are examined along with the reasons therefore and possible drawbacks. Alternative policy choices are then considered, with a brief evaluation of likely consequences, merits, and shortcomings. In discussing options, attention is given to how the quality or productivity of assistance can be enhanced, and how such enhancement can contribute to more efficient policy choices for Indonesia. Special consideration is given to fertilizer production and rice price control. A simulation model is developed and a detailed critique is made of it.

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## **INTERNATIONAL TRANSACTIONS AND REGIONALISM: DISTINGUISHING “INSIDERS” FROM “OUTSIDERS”**

Economics of  
Development  
(continued)

Rand Corp. Charles Wolf, Jr., and David Weinschrott. November 1972. 19 pages.

### **AD-766 873**

If an economic or national unit is considering whether to form, join, or encourage others to form or join a multiunit, international, or regional grouping, what criteria should it use to distinguish those it would like to see inside the group from those it would prefer outside? The report discusses some grouping criteria, what geographic proximity seen as the usual principal factor. Its basis involves the assumption that distance is a reliable indicator of transportation costs. Since technology has made distance a decreasingly reliable indicator of these costs, transportation is only one of many factors affecting cost, demand, and the scale of transactions, all of which enter into the consideration of insiders vs. outsiders. Some mathematical relations are presented, connecting a regression model for costs with a transactions model using world trade data for 152 trading units for the years 1958, 1963, and 1965. Some implications are considered.

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## **A MODEL FOR DEVELOPING A SET OF TOURISM, TRAVEL, AND RECREATION ACCOUNTS FOR A REGION**

Cornell University, Center for Housing and Environmental Studies. William W. Goldsmith, and Barclay G. Jones. October 1967. 53 pages.

### **COM-73-11974**

The report presents a model that was developed as an initial step in studying the impact of tourism, travel, and recreation on the regional economy of Puerto Rico. Following an introductory historical sketch concerning the evolution of leisure time as a concept, the problems of defining the industry are viewed in detail. A system of accounts is arranged to measure the direction and magnitude of visitor flows into and out of the region, flows being measured in terms of vehicle counts, which are translated into traveler flows and then into transaction units. Attention is given to methodologies for measuring purchases and production in a particular sector.

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## **INDUSTRIAL SECTORS AS AGENTS OF SOCIAL AND ECONOMIC CHANGE. THE TOURISM AND TRAVEL INDUSTRY IN PUERTO RICO**

Cornell University, Center for Housing and Environmental

Studies. Barclay G. Jones, and William W. Goldsmith. May 1969. 147 pages.

**COM-73-12011**

There are varied opinions regarding the relationship of tourism and travel to regional development. The report views this particular industry as one inducing social change, since tourism, travel, and recreation provide direct interactions between people. For some regions a number of activities affected by government policy are seen as encouraging or discouraging regional economic development. The industry may be in large part an export sector of the economy. Some flow models for Puerto Rico are constructed, involving vehicle arrivals to the region, households and firms within the region, and activity and expenditure patterns. A discussion is given of vehicle arrival and departure data including recommendations for changes in data collection; methodology for proceeding from vehicle arrival information to visitor expenditure estimates recognizing the difficulty of estimating sales to visitors; relationships of tourism and travel industry accounts with other social accounts; and an approach to a theory of regional economic growth involving internal and external mechanisms. The report then specifies some conditions under which the tourism and travel industry may likely stimulate development in Puerto Rico.

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**THE IMPACT OF THE TOURISM AND TRAVEL  
INDUSTRY ON A DEVELOPING REGIONAL  
ECONOMY: THE PUERTO RICAN CASE**

Cornell University, Department of City and Regional Planning. William Woodbridge Goldsmith. September 1968. 272 pages.

**COM-73-12030**

The document begins with a discussion of the limits to regional development planning and of present controversy regarding them. Next a look is taken at economic development that involves both an area's resources and the entrepreneurship needed to promote them. Then an inquiry is made as to the effect of tourism and travel on levels of development, especially since the issue does not appear to have been sufficiently dealt with. Given that there is a relationship between the level of tourism and the rate of development, the question arises as to whether tourism and travel activity actually lead to development. Some major steps in the resolution of this question are measures of magnitude of expenditures by visitors and of sales to them, and determination of short-run effects on regional economies. Several mechanisms through which externalities of tourism and travel in Puerto Rico encourage development are elaborated. Considerable statistical data are pre-

sented, including ship and airline travel, person flows, and external travel by Puerto Rican residents. Some mathematical models are developed, and some economic forecasts are made.

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**Economics of  
Development**  
(continued)

### **INVESTMENT LAWS OF SELECTED AFRICAN COUNTRIES**

Department of Commerce, Office of International Marketing.  
Marline McKinley. July 1973. 16 pages.

#### **COM-73-50182-32**

A compilation is provided of investment codes of selected African countries. The countries are: Algeria, Cameroon, Ethiopia, Gabon, Ghana, Guinea, Ivory Coast, Kenya, Liberia, Libyan Arab Republic, Morocco, Nigeria, Senegal, Sierra Leone, Sudan, Tunisia, Zaire, and Zambia. The codes define the legal structure affecting employment of domestic and foreign capital within a country, and serve to attract investment from the private sector by offering investments considered vital to that country's economic development. Investment laws clarify conditions for entry and remittance of foreign capital; set forth fiscal provisions affecting both ordinary and special status investments; and specify terms for employment of nationals, for settlement of disputes, and for compensation in the event of expropriation or nationalization.

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### **CAPITAL INTENSITY, ABSOLUTE SIZE, AND GROWTH RATE OF THE SMALL INDUSTRIES SECTOR IN INDIA: A CRITIQUE OF OFFICIAL ESTIMATES**

Cornell University. Jan H. van der Veen. July 1972. 39 pages.

#### **PB-219 689**

The paper provides a critique of official estimates of the capital intensity, absolute size, and growth rate of the small industries sector in India. An examination is made of the procedures adopted by the official agencies in collecting the data upon which the estimates are made. Two distinct approaches are used to collect data: the planning approach and the income approach. Planning estimates are subject to considerable bias and therefore are useless for purposes of economic analysis. Income estimates are hampered by deficiencies in the availability of raw data. Also, there is a diversity of definitions of a "small" industry. The best estimates of the absolute size and growth rate of small industries are those made at the national level by the Central Statistical Organization.

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## **RURAL EMPLOYMENT, MIGRATION AND ECONOMIC DEVELOPMENT: THEORETICAL ISSUES AND EMPIRICAL EVIDENCE FROM AFRICA**

Michigan State University. Derek Byerlee, and Carl K. Eicher. September 1972. 52 pages.

### **PB-219 728**

It is generally predicted that in the 1970's the rate of growth of population will increase, and the industrial-urban sectors will be unable to absorb the increased labor force. In view of this, it is expedient for the nation to develop appropriate strategies and policies for rural employment. The report is intended to provide a framework for analyzing rural employment in national development, to use the framework to analyze empirical labor data, and to present theoretical issues in analyzing the roles of rural employment and migration in economic development. A few topics discussed are use of labor, introduction of cash crops, new technologies and mechanization, rural-urban income differentials, population growth and structural changes, and implications for improved theory.

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## **THE RELEVANCE AND PROSPECTS OF SMALL-SCALE INDUSTRY IN COLOMBIA**

Yale University, Economic Growth Center. Albert Berry. April 1972. 139 pages.

### **PB-219 744**

In absence of adequate documented information on Colombia's small scale industry, a study is made of historical development emphasizing the period beginning 20 years ago, investigating performance in terms of the efficiency in converting resources into output, and studying growth tendencies of industrial plants and firms according to size, and comparing productivity to that of larger industry. Possible strategies are reviewed for the success of this form of production. The data indicate that small and medium plants are operating on somewhat higher output-to-capital ratios than larger ones. Meanwhile, the problems of ascertaining appropriate shadow prices for unskilled labor and various forms of skilled labor make difficult a determination of how overall social factors are related to the economic ones. The question is raised of what role small-scale industry may play in Colombia's subsequent industrial development, and how may it best be handled by policy tools.

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## **EFFECTIVE DEVALUATION AS AN EXPORT INCENTIVE IN LESS DEVELOPED COUNTRIES**

Harvard University, Development Research Group. Jonathan M. Eaton. July 1972. 34 pages.

**Economics of  
Development**  
(continued)

**PB-219 776**

Considerable investigation into the magnitude of demand and substitution elasticities in international trade has taken place since the second world war. Only quite recently, however, has the question of the elasticity of the supply of exports been examined in depth. This document begins with a discussion of the econometric problems encountered in the estimation of such parameters in international trade whereas a subsequent section attempts to enlarge our knowledge of the responsiveness of exports to promotion through the price system by presenting the results of time series analyses performed on export and exchange rate data for seven countries. Elasticities in international trade have been of interest to balance-of-payments theoreticians for two centuries. More recently, as theoretical and empirical research into the problems of economic development has taken place, the implications of supply and demand elasticities for development strategy have become of major concern. The final portion of this study briefly summarizes the implications of elasticities in international trade to issues in balance-of-payments and development theory.

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**DEVELOPMENT, UNEMPLOYMENT, AND  
MARKETING IN LATIN AMERICA**

Michigan State University, Department of Agricultural Economics. Kelly Harrison. April 1972. 33 pages.

**PB-225 640**

Many countries in Latin America have experienced disappointment in striving to maximize the rate of growth in gross national product (GNP), since high GNP growth rates have not brought significant improvement in economic welfare for the masses; instead real per capita incomes have often worsened for low-income families. Thus another approach must be sought for advancing economic organization so that broader participation can be achieved by the people. The traditional approach to development planning has placed great emphasis on increasing production in agriculture and industry. The author holds that a more realistic approach under current conditions in Latin America is to evaluate aggregate demand and then to encourage supply of the appropriate mix of goods and services. The report examines unequal income distribution, high unemployment, wide underemployment, and means to improve the relationship between marketing development and employment in Latin America. The recommended method is to consider social, political, and economic forces that hinder improvement, and to move toward remedying them. Some indications are made for progress in this direction.

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## **EDUCATION & TRAINING**

### **RETURNS TO EDUCATION IN BOGOTA, COLOMBIA**

Rand Corp. T. Paul Schultz. September 1968. 75 pages.

**AD-675 986**

The application of capital theory to investment in people can provide insight into the motivations for decisions and suggest criteria for social investments. Schooling affects an individual's productive capacity, usually increasing his earning potential. Thus resources spent on education may be viewed as investment in the future productive capacity of people. The traditional method for measuring private benefit from increase in productive capacity is criticized as usually overstating the case. The report explores alternative measurements that appear more realistic, with particular regard to Colombia. The private rate of return to various levels of education in that nation are estimated for men and women in the 1965 labor force in Bogota. The average public costs of schooling per student year are estimated and added to the private costs, to estimate a social rate of return for Colombia schooling. Some indications are given for emigration of university graduates to other lands as the result of expansion of public support of higher education without growth in domestic demand for its products.

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### **NEW EDUCATIONAL MEDIA IN ACTION: CASE STUDIES FOR PLANNERS—1**

International Institute for Educational Planning. 1967. 202 pages.

**PB-219 940**

A world-wide research project was undertaken to obtain information on the use of new educational media that may be of value in developing countries. This volume contains case studies selected from the project. The studies are as follows: Educational television in American Samoa; a pioneer in closed-circuit televised instruction; educational radio in Thailand; 10 years of the Radio Rural Forum in India; Japan's broadcast-correspondence high school; Australia's correspondence schools, with supporting broadcast programmes, and Radio University.

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## **NEW EDUCATIONAL MEDIA IN ACTION: CASE STUDIES FOR PLANNERS—3**

International Institute for Educational Planning. 1967. 197 pages.

**PB-219 664**

A world-wide research project was undertaken to obtain information on the use of new educational media that may be of value in developing countries. This volume contains case studies selected from the project. The studies are as follows: The Centro di Tele-scuola programme of Italy; radiovision as an aid to literacy teaching in Niger; radio clubs in Niger; the use of radio by the correspondence school of the New Zealand Department of Education; the radio schools of Honduras; educational television in Nigeria; MPATI: Airborne instructional television in the United States.

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## **SOME EVIDENCE ON EDUCATIONAL RELATIONSHIPS IN CHILE**

Yale University, Economic Growth Center. Marsha Goldfarb. November 1972. 60 pages.

**PB-219 748**

Results are provided of two empirical investigations involving education in Chile. The first study estimates the importance of school and nonschool variables to dropout rate differences among schools. The second study evaluates the impact on worker's earnings of formal education, on the job training, other personal characteristics of the worker, and characteristics of the firm at which the worker is employed. The workers studied reside in Santiago and are employed in manufacturing. The results indicate that models with a human capital orientation developed for predicting the earnings of workers in the labor markets of industrialized countries may be useful for looking at private income determination in the more modern industrial sectors of less developed countries. A variety of factors will affect these earnings: seniority, factors relating to firm size, sex, occupational characteristics, family characteristics, special vocational training, and licensing. All of these factors can have an affect on private earnings. Educational policy makers who neglect these effects may misestimate the return of education itself, and may also overlook other, perhaps lower cost means of raising incomes and outputs.

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## **A DIMENSION OF THE TECHNOLOGY OF EDUCATION: RETENTION OF COGNITIVE SKILLS**

Harvard University, Center for International Affairs. John Simmons. April 1972. 40 pages.

Education &  
Training  
(continued)

**PB-219 770**

The development of cognitive skills in the education process is important in furthering economic and social progress of a country. The retention or improvement of these skills is a factor in assessing the cognitive skill value of a people. This report explores the extent to which individuals with six years of schooling improve or decline in their cognitive abilities after being out of school for various lengths of time, and suggests several reasons for the changes. It analyzes four factors in studying the reasons for retention of literacy (a sample cognitive skill): the individual's education, personality, family characteristics, and post school environment. The report presents data from a survey of urban young men from Tunisia, and also reviews the quantitative literature on retention in some detail.

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**ABILITY TESTING IN DEVELOPING COUNTRIES:  
A HANDBOOK OF PRINCIPLES AND TECHNIQUES**

American Institutes for Research. Paul A. Schwarz, and Robert E. Krug. 1972. 256 pages.

**PB-219 920**

This handbook is primarily concerned with the methodological questions of how ability tests can be adapted for use in a developing country. Principles, techniques, and practical applications are all discussed in detail. The subjects covered include the following: Conditions under which test adaptation should or should not be considered; investment in testing reform from a cost effectiveness point of view; the methodology of test adaptation; application of these principles and techniques to 19 aptitude tests; and final translation of completed test instruments into operational programs. A number of techniques not affected by cultural variations are described. Developmental studies carried out in Africa and generalized studies in Brazil, Korea, and Thailand are described.

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**RESEARCH MANAGEMENT AND TECHNICAL  
ENTREPRENEURSHIP: A U.S. ROLE IN IMPROVING  
SKILLS IN DEVELOPING COUNTRIES**

National Academy of Sciences, Board on Science and Technology for International Development. K. N. Rao, L. W. Bass, J. P. Blackledge, et al. 1973. 49 pages.

**PB-225 129**

As the role of science and technology in national development processes has become better understood, a point of weakness has appeared: the limited capacity of developing countries, for the most part, to organize research and apply it most productively. The report reflects an initial effort by specialists to devise a tech-

nical assistance program aimed at remedying this situation. It examines research management as a part of technical management. An argument is presented for an experimental approach by a particular nation to try out and effect avenues of training in concert with other countries similarly engaged to the fullest extent possible within these developing countries. Discussions are presented of problems of technical management in lesser developed countries, programs to develop such management, U.S. expertise and training that may be used, and some recommendations for action. Human, institutional, and industrial potentials are noted in the planning area.

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**Education &  
Training  
(continued)**

**EVALUATION OF THE AFRICAN  
PRIMARY SCIENCE PROGRAM**

Education Development Center. Eleanor Duckworth. September 1970. 42 pages.

**PB-225 601**

The African Primary Science Program encompasses an innovative approach to teaching general science to primary grade children. The objective is to develop in children a first-hand familiarity with the things in nature about them, knowing what to expect of them and being able to predict what they would do, and knowing how they can be used. It also seeks to develop a curiosity about things, an interest in finding out more about them even when the children were not in school; and to encourage the children to think for themselves. The report covers activities centered in Ghana, Kenya, Malawi, Nigeria, Sierra Leone, Uganda, and Tanzania. It presents an evaluation of the African Primary Science Program, the work that was done in accordance with the evaluation, and an indication of what can further be done. A main premise was that goals of the program cannot be tested by examination techniques. Comparison was made between some of the African children taught by teachers in the program for one to three years with children who had not been taught by such teachers. The results indicate that the method is successful.

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**PROGRAMMING FOR CHANGE  
IN SCIENCE EDUCATION**

Education Development Center. Ralph H. Robins. September 1970. 39 pages.

**PB-225 602**

The African Primary Science Program, begun in 1965 as one component of a larger program of curriculum reform, was directed toward determining to what extent new methods and materials being developed in the US and the United Kingdom may be used in schools of the developing countries. The focus has been on



Africa, but the information gained should be of wider use. The present monograph summarizes particular experiences within the framework of science teaching administration: International programming, organization and policy, staffing, materials development and production, and financing. The discussion is arranged under the heads of policy making, staffing for change, tactics of innovation, change of goals, opportunities for international efforts, printed material, hardware materials, films, and development of the African staff. Although success of the effort is difficult to pinpoint, improvements have been evident in government policies, personal motivation, and institutional support. The important factor is how the efforts affect children's perceptions of the world. Liberia, Sierra Leone, Ghana, Nigeria, Kenya, Tanzania, Uganda, and Malawi have participated in the program.

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**INDIAN EDUCATIONAL MATERIAL. VOL. 7, NO. 1**

Indian National Scientific Documentation Centre. A. Joseph (Ed.). March 1972. 102 pages.

**TT-72-51009/01**

**INDIAN EDUCATIONAL MATERIAL. VOL. 7, NO. 2**

Indian National Scientific Documentation Centre. A. Joseph (Ed.). June 1972. 89 pages.

**TT-72-51009/02**

**INDIAN EDUCATIONAL MATERIAL. VOL. 7, NO. 3**

Indian National Scientific Documentation Centre. A. Joseph (Ed.). September 1972. 89 pages.

**TT-72-51009/03**

**INDIAN EDUCATIONAL MATERIAL. VOL. 7, NO. 4**

Indian National Scientific Documentation Centre. A. Joseph (Ed.). December 1972. 81 pages.

**TT-72-51009/04**

This series of documents contains English-language abstracts of articles, monographs, etc., that have been published in India and that concern Indian education. Some of the topics covered include: Academic achievement, administration and organization, adult education, courses of study, curriculum, economics of education, educational psychology, educational research, educational sociology, examination and evaluation, extracurricular activities, finance, forms of education, guidance and counselling, higher education, higher vocational education, history, inspection, instructional material and aids, moral education, physical education, policy and planning, preprimary education, primary education, reading, social education, social science research, special education, statistics, student indiscipline, student selection, teacher

education, teachers, teaching methods, tests and measurements, vocational and technical education, women's education, worker's education. In addition. No's. 1 and 2 each contain a special section on technical education; and No's. 3 and 4 each contain a special section on agricultural education.

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Education &  
Training  
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**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS IN PAKISTAN. VOL. 5, NO. 1.  
JANUARY-MARCH 1971**

Department of Health, Education, and Welfare, Office of Education; and National Science Foundation. Geti Saad. 1971. 57 pages.

**TT-72-53025/1**

**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS IN PAKISTAN. VOL. 5, NO. 2.  
APRIL-JUNE 1971**

Department of Health, Education, and Welfare, Office of Education; and National Science Foundation. Geti Saad. 1971. 60 pages.

**TT-72-53025/2**

**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS IN PAKISTAN. VOL. 5, NO. 3.  
JULY-SEPTEMBER 1971**

Department of Health, Education, and Welfare, Office of Education; and National Science Foundation. Geti Saad. 1971. 54 pages.

**TT-72-53025/3**

**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS IN PAKISTAN. VOL. 5, NO. 4.  
OCTOBER-DECEMBER 1971**

Department of Health, Education, and Welfare, Office of Education; and National Science Foundation. Geti Saad. 1971. 64 pages.

**TT-72-53025/4**

The documents in this series contain English-language abstracts of materials published in Pakistan pertaining to education in that country. The topics covered include: Administration, organization, and financing of education; adult education; childhood education; comparative education; curriculum; development of education; education goals; education planning; educational research; elementary, secondary education; examinations; health education; history of education; islamic education; language teaching; libraries; medical education; philosophy of education; psychology; science education; sociology; students' problems; teachers; technical education; and textbooks.

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**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS IN PAKISTAN. VOL. 6, NO. 1.  
JANUARY-MARCH 1972**

Department of Health, Education, and Welfare, Office of Education; and National Science Foundation. Geti Saad. 1972. 63 pages.

**TT-72-53188/01**

**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS IN PAKISTAN. VOL. 6, NO. 2.  
APRIL-JUNE 1972**

Department of Health, Education, and Welfare, Office of Education; and National Science Foundation. Geti Saad. 1972. 57 pages.

**TT-72-53188/02**

The documents in this series contain English-language abstracts of materials published in Pakistan pertaining to education in that country. The topics covered include: Administration, organization, and financing of education; agricultural education; childhood education; curriculum; development of education; education goals; education planning; education reforms; elementary and secondary education; examinations; higher education; Islamic education; language teaching; libraries; literacy; literature for children, medical education; philosophy of education; professional education; psychology; science education; sociology; special education; student's problems; teachers; teaching methods and media; technical education; textbooks; and education of women.

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**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS: ALGERIA, LIBYA, MOROCCO, TUNISIA.  
VOL. 5, NO. 1**

Agence Tunisienne de Public-Relations. Azzedine Azzouz, Margaret Duggan Saidi, and Cathleen Sullivan Chahed. 1971. 28 pages.

**TT-72-55026/01**

**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS: ALGERIA, LIBYA, MOROCCO, TUNISIA.  
VOL. 5, NO. 2**

Agence Tunisienne de Public-Relations. Azzedine Azzouz, Margaret Duggan Saidi, and Cathleen Sullivan Chahed. 1971. 31 pages.

**TT-72-55026/02**

**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS: ALGERIA, LIBYA, MOROCCO, TUNISIA.**



**VOL. 5, NO. 3**

Agence Tunisienne de Public-Relations. Azzedine Azzouz, Margaret Duggan Saidi, and Cathleen Sullivan Chahed. 1971. 30 pages.

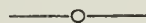
**TT-72-55026/03**

**SELECTED BIBLIOGRAPHY OF EDUCATIONAL  
MATERIALS: ALGERIA, LIBYA, MOROCCO, TUNISIA.  
VOL. 5, NO. 4**

Agence Tunisienne de Public-Relations. Azzedine Azzouz, Christiane Djemili, and Margaret Duggan Saidi. 1971. 43 pages.

**TT-72-55026/04**

This series is a compilation of English-language abstracts dealing with education in the Maghreb. The topics covered include: Philosophy and theory of education; administration of the educational system; educational statistics; structure of educational organization in North Africa; primary, secondary, vocational, and higher educational organization; adult education; teaching aids; religious education; artistic education; special education; cooperation; and special problems, such as Arabization, student unrest, etc.



**EDUCATION ABSTRACTS: BURMA. VOL. 5, NO. 1.  
JANUARY-APRIL 1971**

National Science Foundation. U Ba. 1971. 55 pages.

**TT-72-57000/01**

**EDUCATION ABSTRACTS: BURMA. VOL. 5, NO. 2.  
MAY-AUGUST 1971**

National Science Foundation. U Ba. 1971. 57 pages.

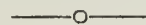
**TT-72-57000/02**

**EDUCATION ABSTRACTS: BURMA. VOL. 5, NO. 3.  
SEPTEMBER-DECEMBER 1971**

National Science Foundation. U Ba. 1971. 58 pages.

**TT-72-57000/03**

The documents in this series are comprised of English-language abstracts of materials published in Burma and that pertain to Burmese educational concerns. Various topics in general, primary, secondary, higher, and vocational/technical education are included, along with a number of miscellaneous and special topics related to education.



# ENERGY SOURCES

## SOLAR ENERGY EVALUATION GROUP REPORT

Argonne National Laboratory. E. H. Appelman, S. S. Danyluk, et al. August 1973. 52 pages.

### ANL-8045

The sun is an inexhaustible and essentially nonpolluting energy source that has the potential to satisfy a substantial fraction of the world's future energy needs. The sun's energy may be harnessed in several ways which are scientifically and technologically feasible. Their engineering and economic feasibility depends on how well the energy provided by these processes can compete with energy from nuclear and fossil fuels. Hence the main thrust of research and development in the application of solar energy must be toward finding a more economical way of doing the job. This report covers a partial review of the status of various phases of solar-energy utilization and of some of the areas of potentially profitable research. The review covers the biological and in vitro aspects of the photochemical conversion of solar energy; the photovoltaic, photothermal, and thermoelectric studies of the physical-conversion process; the use of solar energy for heating and cooling buildings; and finally, the central-station power approach.

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## QUANTITATIVE ENERGY STUDIES AND MODELS: A STATE-OF-THE-ART REVIEW

Decision Sciences Corp. Dilip R. Limaye, Robert Ciliano, and John R. Sharko. March 1973. 91 pages.

### PB-220 131

## QUANTITATIVE ENERGY STUDIES AND MODELS. APPENDIXES

Decision Sciences Corp. Dilip R. Limaye, Robert Ciliano, and John R. Sharko. March 1973. 113 pages.

### PB-220 132

This document contains the results of a state-of-the-art review of quantitative energy studies and models. The objective is to evaluate analytical studies of energy relative to the development of a comprehensive model for analyzing the probable environmental

consequences of energy policy options. The review includes an examination of the significant characteristics of each study and a comprehensive bibliography of the current research work involving analytical techniques for the evaluation of energy policy issues. The basic report is contained in PB-220 131; the bibliography and summaries of the studies reviewed are contained in PB-220 132.

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### **PROCEEDINGS, SECOND ENERGY RESOURCE CONFERENCE**

University of Kentucky, College of Engineering. O. J. Hahn (Ed.). August 1973. 59 pages.

#### **PB-224 750**

The rapidly increasing demand for energy in the developed countries, the steadily growing need for it in the developing countries, and the increasing per capita consumption of energy throughout a world whose population growth is not yet under control are all factors that have contributed to a worldwide energy dilemma. This document is comprised of the proceedings of a conference that was held in October 1972 to consider some of the technological approaches to the resolution of this dilemma. Included among the topics covered are the following: Improvements in energy conversion technology to conserve resources; new developments in the extraction of natural gas; new developments in the extraction of oil; conversion to coal to gaseous and liquid fuels; conversion of coal by gas to the Lurgi process; transportation and transmission of energy.

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### **PROCEEDINGS OF THE ANNUAL APPALACHIAN GAS MEASUREMENT SHORT COURSE (30TH)**

West Virginia University, Engineering Experiment Station. Donald M. Bondurant (Ed.). March 1971. 454 pages.

#### **PB-225 695**

The Short Course was established by several cooperating organizations, companies, and manufacturers to provide training in installing, using, and maintaining equipment used to measure fuel gas quantities and to measure and control pressures; and to provide a clearing house for the presentation of new developments in the field. This volume contains 62 papers presented at the 1971 Short Course. The range of topics covered includes: Basic electronics and gas laws as well as the fundamentals of various meters; domestic meters as tested, corrected, operated, and maintained, including remote reading varieties; large capacity displacement meters with attention to transfer testing, turbine, CVM, rotoseal, and Roots instruments; orifice and other flow meters; instrumentation, planning, and design; regulators; telemetering, data handling, and automation; and general and supervisory techniques.

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**PROCEEDINGS OF THE ANNUAL APPALACHIAN  
GAS MEASUREMENT SHORT COURSE (31ST)**

West Virginia University, Engineering Experiment Station. Donald  
M. Bondurant (Ed.). March 1972. 467 pages.

**PB-225 696**

The document contains 63 reports aimed at providing training in installing, using, and maintaining fuel gas measurement equipment. Topics of interest include the principles of displacement, orifice, turbine, and velocity meters, as well as basic corrective devices and gas laws; pressure regulators, bell proving, tin meter repair, remote and automatic meter reading, and accelerated meter testing; large capacity displacement meters, involving selection, testing, adjustment, and fixed factor metering; orifice and other flow meter methods; instrumentation; planning and design; regulators and regulation; telemetering systems, automatic control of low pressure systems, transducers, and computer operated data processing; electronic density measuring system; liquefied natural gas; self drag valves; electroscanners; and chart processing techniques.

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# **ENVIRONMENTAL TECHNOLOGY**

## **ENVIRONMENTAL POLLUTION:**

### **NOISE POLLUTION—NOISE EFFECTS ON HUMAN PERFORMANCE. A DDC BIBLIOGRAPHY**

Defense Documentation Center. November 1973. 170 pages.

#### **AD-769 900**

This bibliography contains abstracts of reports resulting from US Government-funded research on the effects of environmental noise on human performance. The references deal primarily with effects of noise exposure on hearing, speech, and communications, and with the problem of the effects of airport noise on the surrounding community. The period covered is 1971-73. Subject and author indexes are included. The reports listed in this bibliography are available from NTIS.

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## **ENVIRONMENTAL POLLUTION:**

### **AIR POLLUTION—PARTICULATE MATTER. A DDC BIBLIOGRAPHY**

Defense Documentation Center. November 1973. 127 pages.

#### **AD-769 960**

This bibliography contains abstracts of reports dealing with the pollution of air by particulate matter. Topics covered include: analysis of atmospheric aerosols and particulate matter; measurement, distribution, and identification of pollutants; the atmospheric motion of aerosol particles; dust and pollen. The period covered is 1971-73. Subject and author indexes are included. The reports listed are available from NTIS.

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## **ENVIRONMENTAL POLLUTION:**

### **AIR POLLUTION—EXHAUST GASES. A DDC BIBLIOGRAPHY**

Defense Documentation Center. December 1973. 94 pages.

#### **AD-771 710**

Emphasis of this report is on exhaust gases emanating from ground and air transportation activities. The period covered is 1971-73.

Subject and author indexes are included. The reports listed in this bibliography are available from NTIS.

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### **COOLING PONDS—A SURVEY OF THE STATE OF THE ART**

Hanford Engineering Development Laboratory. J. C. Sonnichsen, S. L. Engstrom, et al. September 1972. 110 pages.

#### **HEDL-TME-72-101**

In thermal power systems, the waste heat is removed by circulating large quantities of cooling water through steam condensers. The heated water is then either discharged or cooled and returned to the system. One of the methods of avoiding adverse environmental effects through the discharge of this heated water involves the use of cooling ponds. The design of cooling ponds is still largely an art, although during the past few years there has been a resurgence of interest in a more technical approach. This document presents a review of cooling pond technology. The topics covered include: Diking and baffling; heat transfer; equilibrium temperature concept; water usage; pond volume and depth considerations; modeling the properties of cooling ponds; environmental considerations; spray ponds; operations; and economics.

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### **ESTUARINE POLLUTION, A BIBLIOGRAPHY**

Water Resources Scientific Information Center. April 1973. 500 pages.

#### **PB-220 119**

This bibliography provides abstracts from the literature concerning the pollution of estuaries. Some of the principal topics are eutrophication, algae, benthic fauna, dissolved oxygen, nutrients, pesticides, phytoplankton, radioactivity, salinity, thermal pollution, pollution sources, and water quality control. Materials are presented also on sediments, chemical properties, coastal environments, conferences, dredging, environmental engineering, estuarine characteristics, fish, landfills, model studies, nuclear wastes, oil spills, phosphates, bay and river ecology, sewage, toxic qualities, and water resource conservation.

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### **BIOLOGICAL CONSEQUENCES OF PLANT RESIDUE DECOMPOSITION IN SOIL**

National Environmental Research Center. W. C. Snyder, Z. A. Patrick, and A. R. Weinhold. November 1972. 144 pages.

#### **PB-222 113**

Plant materials returned to the soil, and their decomposition products have long been considered as having important effects



on all phases of plant development including soil productivity, severity of root disease, and biological control of soil-born diseases. As with most problems associated with the soil, results obtained by various investigators have often been ambiguous, difficult to interpret, or open to controversy. This report provides the results of a seven-year study of the basic aspects of the problem of the biological consequences of crop residue decomposition in soil. Analyses were made of the decomposition products in field soils, and some of the more active ones were chemically defined. Toxicities of these products to seedlings and to roots of field grown crops were tested using many different organic residues under different moisture levels, timing, and conditions of aeration. The effect of crop residues on the behavior of soil-borne plant pathogens were observed and the role of these organic residues upon the epidemiology of seedling diseases followed. Both favorable and unfavorable effects of crop residues in agriculture were demonstrated and analyzed.

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#### **QUALITY OF LIFE INDICATORS—A REVIEW OF STATE-OF-THE-ART AND GUIDELINES DERIVED TO ASSIST IN DEVELOPING ENVIRONMENTAL INDICATORS**

Environmental Protection Agency, Washington Environmental Research Center. Martin W. Brossman. December 1972. 88 pages.

##### **PB-225 034**

In addition to economic conditions in a nation, social and environmental factors have an important role in determining the well being of a nation and its people. The report describes the need for, and properties of, effective quality of life indicators, their historical evolution, and guidelines for indicator development and use. It discusses specific developments in economic, social, environmental, and quality of life indicators. The establishment of such indicators could lead to improved cost-benefit analysis at the national level.

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#### **ATMOSPHERIC EMISSIONS FROM THE PETROLEUM REFINING INDUSTRY**

Environmental Protection Agency, Control Systems Laboratory. L. L. Laster. August 1973. 55 pages.

##### **PB-225 040**

This document summarizes the air pollution problems of the petroleum refining industry, with emphasis on gaseous emissions. It begins with a general outline of the refining process, including the steps of separation, conversion, treating, and blending. Consideration is next given to factors contributing to the emission

of pollutants. This includes a discussion of emission control equipment and methods in use, sulfur content of raw materials, refining operations, housekeeping and maintenance practices, and major sources of pollutant emission. The final portions cover available, needed, and interim methods for the control of emissions of sulfur dioxide, nitrogen oxides, particulates, and odors.

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### BIOLOGICAL CONTROL OF WATER WEEDS WITH PLANT PATHOGENS

Florida Water Resources Research Center. T. E. Freeman, R. Charudattan, et al. August 1973. 67 pages.

#### PB-225 473

Excessive populations of water plants create havoc in waterways. They clog drainage and irrigation canals, interfere with navigation, and curtail other human activities normally associated with water bodies. Unfortunately, the water weed problem, which is already of considerable magnitude, is growing rather than diminishing. The reasons for this are complex but are definitely related to man and his activities. This document describes the results obtained during the first three years of a program aimed at examining the use of plant pathogens as biocontrols of water weeds. A survey of plant diseases was made in the US, Puerto Rico, Guatemala, El Salvador, Panama, Colombia, Mexico, Barbados, Jamaica, Trinidad and India. Several potentially useful diseases were found and their causal agent isolated. Promising pathogenic controls were found to include the following: (1) *Rhizoctonia Solani*, *Cephalosporium Zonatum*, and the Rodman disorder on water hyacinth; (2) Viral induced stunt of Alligatorweed; and (3) *Pythium*, *Sclerotium*, and *Penicillium* on hydrilla.

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### AEROBIOLOGY AND ITS MODERN APPLICATIONS

University of Michigan. Robert L. Edmonds and William S. Benninghoff. July 1973. 19 pages.

#### PB-225 535

Aerobiology is a scientific discipline focused on the transport of organisms and biologically significant materials by the atmosphere. Attention is given to the source of the organisms or materials, release into the atmosphere, dispersion, deposition, and impact on animal, plant, or human systems. This document describes the development of aerobiology, with emphasis on the period of the International Biological Program from 1968 to 1973. The economic and ecological impact of aerobiological phenomena on food and fiber crop production, natural and managed vegetation, and human and animal health are discussed along with the achievements of in the understanding and control of these phenomena. A final section looks at the probable future direction of the field.

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# FISHERIES & AQUACULTURE

## GUIDE TO THE LOBSTERS AND THE LOBSTER-LIKE ANIMALS OF FLORIDA, THE GULF OF MEXICO, AND THE CARIBBEAN REGION

University of Miami. Lee Opresko, Dennis Opresko, et al. August 1973. 47 pages.

**COM-74-10007**

This manual is intended to provide the nonspecialist with a means of identifying both shallow-water and deep-water lobsters that are either already fished commercially or might be fished if sufficient stocks could be discovered. To accomplish this end, a taxonomic key is given together with explanatory illustrations of the important features used for identification. Preference is given to conspicuous external characters such as shape, coloring and sculptural features. The known geographical distribution of the various species is included in the descriptions, along with known depth ranges. Insofar as known, growth rates, spawning times, temperature, bottom conditions, and other pertinent data are given. Finally, information is provided on the present fisheries, size of catch, gear used in the fishery, and suggested modification or improvement of commercial gear wherever applicable.

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## AQUACULTURAL SURVEY IN JAPAN

Auburn University, International Center for Aquaculture. H. R. Schmitton. February 1972. 73 pages.

**PB-219 739**

Japan has made very important contributions to the field of aquaculture and has led the world in developing cultures of marine and brackish-water organisms. This document provides an assessment of the value of Japan's aquacultural methods in terms of direct or indirect application in other countries. A summary is given of each of several selected types of aquaculture currently in practice. These involve the Japanese eel (*Anguilla japonica*), the ayu (*Plecoglossus altivelis*), the yellowtail (*Seriola quinqueadiata*), the Japanese oyster (*Crassostrea gigas*), and the Japanese shrimp (*Penaeus japonicus*). For each species, information is given on the general biology of the organism, cultural methods and



practices, and problems and future prospects of the culture. Also included are descriptions of selected aquacultural stations, laboratories, and private farms.

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## MASS CULTIVATION OF INVERTEBRATES— BIOLOGY AND METHODS

Israel Program for Scientific Translations; National Marine Fisheries Service; and National Science Foundation. I. V. Ivleva. 1973. 153 pages. (Translated into English by A. Mercado from *Biologicheskie osnovy i metody massovogo kul'tivirovaniya kormovykh bespozvonochnykh*, Moscow, 1969)

### TT-72-50055

Experience in the pond breeding and rearing of fish has shown that best results are obtained when the fish are furnished with live foods. An important method for supplying these foods is by the large-scale cultivation of invertebrate food organisms. This book provides an introduction to this field of applied biology. Specific consideration is given to the following organisms: Soil oligiochetes, with particular attention to the white worm (*Enchytraeus albidus*); free-living nematodes, especially microworms (*Panagrellus*); branchipod crustaceans, especially brine shrimp (*Artemia*) and fairy shrimp (*Staeptocephalus*); daphnia; and chironomid larvae. The biology of these organisms is characterized, and their gross morphology is briefly outlined. Attention is given to distribution and relation to environmental factors; reproduction, growth, and development; population growth; feeding; chemical composition of the body; and respiration. The description of culture methods includes such information as initial and peak density of the culture, rearing periods, the maintenance of optimal conditions, manipulations of the culture, feeds and feeding regime, and output.

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## DISEASES OF POND FISHES

Israel Program for Scientific Translations; Department of the Interior; and National Science Foundation. O. N. Bauer, V. A. Musselius, and Yu. A. Strelkov. 1973. 227 pages. (Translated into English by A. Mercado from *Bolezni prудovykh ryb*, Moscow, 1969)

### TT-72-50070

Pond-reared fish are becoming increasingly important as a source of protein in many areas of the world. One method of increasing the productivity of rearing ponds is to increase the density of fish grown per unit area. Such an increase, however, often promotes the outbreak of diseases. This book addresses itself to the causes of such diseases and measures for their prevention. It concerns

modern methods for the identification, prevention, and treatment of infectious, parasitic, and noncommunicable diseases of pond fish. Particular attention to the etiology, biology, and epizootology of the disease agents, since knowledge in these fields is necessary for the control of the diseases of fish. Detailed procedures for the pathological examination of fish are included.



**Fisheries &  
Aquaculture**  
(continued)

## **FOOD & NUTRITION**

### **PROCEEDINGS, SYMPOSIUM ON FLEXIBLE PACKAGING FOR HEAT-PROCESSED FOODS**

Army Natick Laboratories; and National Academy of Sciences, Committee on Container Development. September 1973. 106 pages.

#### **AD-768 729**

Flexible packages for heat processed foods have a number of advantages that make them commercially attractive: They maintain foodstuffs in high quality; they enhance convenience in preparation; they provide good shelf life; they are lighter and simpler to open than metal cans; etc. This document is comprised of the proceedings of a symposium, held in November 1972 that dealt with the current status and future prospects of a system for thermoprocessing foods in flexible packages. Some of the specific topics covered include: bakery items in flexible packages; reliability of package forming and filling; feasibility of retorting foods in flexible packages; test procedures and performance values required to assure reliability.

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### **THE ACCEPTABILITY OF WHEY-SOY MIX AS A SUPPLEMENTARY FOOD FOR PRESCHOOL CHILDREN IN DEVELOPING COUNTRIES**

Army Natick Laboratories, Pioneering Research Laboratory. H. L. Jacobs, R. C. Graeber, et al. December 1973. 21 pages.

#### **AD-772 930**

Because of increasing food prices, commodity scarcities, and budget cuts, it became necessary by late 1972 to find a substitute for the nonfat dry milk that had been a major element in the Food for Peace preschool child feeding programs. A nutritionally adequate potential substitute was developed that was composed of a mixture of sweet whey, full-fat soy flour, soybean oil, corn syrup solids, and a vitamin and mineral mix. The Food for Peace program has had relatively little experience with testing new foods. The Pioneering Research Laboratory was therefore requested to employ its expertise to develop, test, refine, and apply a methodology for determining the acceptability of the new bev-



erage powder to preschool children in developing countries. This report describes the results of this effort. The actual acceptability testing was carried out in Chile, Dominican Republic, India, Pakistan, Sierra Leone and Vietnam. The results indicate that the beverage powder should be acceptable in all of these countries except possibly Sierra Leone. Of more general interest is the food acceptability testing methodology that is described in the report.

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**Food & Nutrition**  
(continued)

### **PROFIT BY CAMERAS: SEAFOOD PROCESSING TIME-MOTION STUDIES FOR DESIGN OF BETTER SYSTEMS**

Oregon State University, Engineering Experiment Station. William F. Engesser. 1973. 26 pages.

#### **COM-74-10045**

By evaluating camera-recorded motions, processors can determine optimum handling of seafood for meat extraction and thereby increase immediate profits. It is demonstrated in this document how motion picture analysis can define and measure current seafood processing operations. Actual and proposed benefits are identifiable by standard-cost data developed from camera studies of various finfish and shellfish processing operations. Studies were made of female handlers using manual methods and of mechanical equipment in operation. The films were used to train personnel and to gain insight into mechanical optimization.

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### **AN EXPLORATION OF THE ECONOMICS OF TASTE AND DEMAND FOR FOOD**

University of Minnesota, Economic Development Center. Sachiko Yamashita. July 1973. 162 pages.

#### **PB-225 547**

The traditional economic analysis of consumer demand generally ignores questions pertaining to the formation of tastes and changes in taste. This may be due to the fact that since tastes change slowly, to give tastes an explicit empirical treatment has been a difficult problem. This paper advances the hypothesis that relative commodity prices induce taste. The hypothesis is tested using intercountry cross-sectional data for 43 countries and 22 food commodities. After a brief review of the literature about tastes, a conceptual framework is established to construct a model for an intercountry cross-sectional analysis to explain differences in tastes among the countries examined. A model for estimating the demand function from time-series data to explain the changes in tastes induced by past consumption is developed. Then the results of the time-series analysis are presented and their meanings

are explored. Finally, a tentative conceptual hypothesis about the mechanism of endogenous changes of taste in the framework of induced innovative theory in production is presented.

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### COMPONENTS OF NUTRITIONAL QUALITY IN GRAIN SORGHUM

Purdue University Agricultural Experiment Station. J. D. Axtel and T. E. Mertz. 1972. 22 pages.

#### PB-225 549

Several factors affect nutritional quality in cereal crops, and the nutritional problems in sorghum parallel those in other major cereals in many respects. The major components of nutritional quality in sorghum are as follows: Prolamine content and embryo size, which affect lysine content and thus protein quality; and tannin content, which affects protein availability. These factors are discussed in this paper, and the status of efforts toward improving the nutritional quality of grain sorghum is described. Some of the specific topics covered are: Amino acid composition; fractionation of whole grain and endosperm proteins; growth response of rats relative to lysine and tannin content; frequency of high tannin sorghum genotypes in the world collection; alkali dehulling of high and low tannin sorghum grain; supplementation with soybean meal.

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# HIGHWAY ENGINEERING

## HANDBOOK OF APPLICATIONS OF STATISTICAL CONCEPTS TO THE HIGHWAY CONSTRUCTION INDUSTRY. PARTS 1, 2, & 3

Materials Research and Development, Inc. S. B. Hudson. June 1971. 509 pages.

### PB-220 593-Set

This three-volume handbook deals with practical concepts in the field of mathematical statistics and with their application in the control of materials and procedures in highway construction. Part 1 presents introductory explanations pertaining to general principles of statistics that will be useful to technicians in highway engineering or construction and to producers of materials. Emphasis is on showing by numerical examples how these principles are applied in practical highway work. Part 2 concerns the application of principles of statistics in the preparation of specifications that control acceptance of the completed construction. Part 3 contains more advanced statistical methods that are of interest to a person who has to prepare reports or is engaged in research pertaining to such topics as the design of experiments, the analysis of variances, the methods of finding relationships between measured values, and the methods of selecting curves to represent the results of tests. The information in this handbook can be understood and used by persons having a fair knowledge of ordinary arithmetic. (The parts of this handbook are also available individually: Part 1 as PB-220 594; Part 2 as PB-220 595; Part 3 as PB-220 596.)

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## STRESS-CORROSION SUSCEPTIBILITY OF HIGHWAY BRIDGE CONSTRUCTION STEELS

Boeing Co. C. S. Carter, M. V. Hyatt and J. E. Cotton. April 1972. 305 pages.

### PB-222 453

Collapse of a West Virginia highway bridge in 1967 was investigated and attributed to stress corrosion cracking of an eyebar, calling attention to a lack of consideration of this feature in bridge design. The goal of the reported program has been to determine the potential danger of stress corrosion to highway



bridge structures. The following factors are considered most important: Types of bridge steels and stress magnitudes during service; stress-corrosion susceptibility of the steels; and occurrence of corrosives that can promote stress-corrosion cracking in extreme highway environmental conditions. A catalog of steels used in highway bridge construction was assembled, and a state of the art survey was made on the stress-corrosion susceptibilities of these steels. Findings are presented. The types and concentrations of corrosives that can be experienced have been established. Some of the key topics are hydrogen embrittlement, fracture mechanics, and air pollution. The report contains chapters on testing methods, water and aqueous chloride solutions, hydrogen sulfide, nitrates, hydroxides, ammonia, and other compounds; water pollution; bird droppings, and recommended tests.

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**EVALUATION OF GAP-GRADED ASPHALT  
CONCRETE MIXTURES. PART 1:  
MECHANICAL PROPERTIES**

Iowa State University, Engineering Research Institute. Dah-Yinn Lee, Herbert T. David and Richard W. Mensing. January 1973. 132 pages.

**PB-222 632**

**EVALUATION OF GAP-GRADED ASPHALT  
CONCRETE MIXTURES. PART 2:  
STATISTICAL DESIGN AND ANALYSIS**

Iowa State University, Engineering Research Institute. Richard W. Mensing, Dah-Yinn Lee and Herbert T. David. February 1973. 61 pages.

**PB-222 633**

**EVALUATION OF GAP-GRADED ASPHALT  
CONCRETE MIXTURES. PART 3: APPENDIX**

Iowa State University, Engineering Research Institute. Dah-Yinn Lee, Herbert T. David and Richard W. Mensing. January 1973. 76 pages.

**PB-222 634**

Because of the increasing demand for high quality, more durable, high skid and wear resistant paving mixtures for modern traffic, and because of increasing costs for producing maximum density or well-graded aggregates in many areas, the potential advantages of using gap-graded aggregates in both portland cement and asphalt concretes are attracting attention throughout the world. This report presents the results of a comparative laboratory examination of well-graded and gap-graded aggregates used in asphalt concrete paving mixtures. The results indicate that, with proper

combinations of aggregates and asphalts, both continuous and gap-graded aggregates can produce mixtures of high density and of qualities meeting current design criteria. For this reason it is recommended that aggregate grading limits be relaxed or eliminated and that the suitability of an aggregate be based on individual mixture evaluation. The main experimental results and discussion are given in Part 1. The statistical treatment of the experimental data is covered in Part 2. The appendixes of Part 3 are comprised largely of raw experimental data. (The three parts of this report are available at a lower total price as a set. The order number is PB-222 631-SET).

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### **IMPROVED TENSILE STRENGTH FOR CEMENT-TREATED BASES AND SUBBASES**

University of Texas, Center for Highway Research. Robert F. Cauley, and Thomas W. Kennedy. December 1972. 61 pages.

#### **PB-222 779**

This report provides a summary of an evaluation and interpretation of the results from previous studies concerning the tensile and shrinkage characteristics of cement-treated roadway subbase materials. The effects on tensile strength produced by eight factors known to be important are analyzed in detail and effects are evaluated in terms of their significance and relationship to shrinkage cracking of cement-treated materials. It is shown that there is an optimum water content that produces optimum tensile strength for a given type of soil and cement content. It is also shown that tensile strength increases and cracking decreases with a decrease in the amount of cohesive material in the mixture, an increase in cement content, sealed curing, and extended curing periods. A new mix design procedure, based on these results, is outlined. In addition, recommendations regarding the construction of cement-treated bases and subbases for improved tensile strength and reduced shrinkage cracking are made.

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### **SOIL STABILIZATION**

National Academy of Sciences, Highway Research Board. K. P. George, J. H. W. Wang, et al. 1973. 130 pages.

#### **PB-222 920**

This is a group of 11 papers covering many aspects of soil stabilization, ranging from the mechanisms of shrinkage in soil-cement bases to stabilization of sand with cationic bitumen emulsion. Also included is information on methods of improving the tensile strength of soil-cement, and a description of factors that affect the creep behavior of cement-stabilized soils. Of particular interest is a series of indexes of lime reactivity of different soil groups, with emphasis on those of the tropical and subtropical areas.

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## PROBABILITY THEORY FOR HIGHWAY BRIDGE FATIGUE STRESSES

Case Western Reserve University, Division of Solid Mechanics, Structures and Mechanical Design. Fred Moses, and Robert C. Garson. July 1973. 260 pages.

### PB-224 913

Trends in current automotive truck design, along with increases in heavy truck traffic, are causing concern about the possibility of fatigue failures in highway bridges. Accordingly, descriptions of fatigue-causing loads are needed that reflect actual vehicle patterns, as well as additional knowledge about materials behavior. The report describes an analytical project to calculate histograms of highway bridge loadings that can be used to predict fatigue and to properly size girder sections. A probabilistic load model is developed using truck volumes and weights, headway spacing between trucks, impact factors, and distribution analysis. A reliability or risk approach to choosing safety factors is also presented. Illustrations are given of single span bridges of different lengths, weld categories, truck records of different states, parallel and opposing flow bridges, and three span continuous bridges.

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## DESIGN, CONSTRUCTION, AND MAINTENANCE OF PCC PAVEMENT JOINTS

National Research Council, Highway Research Board. 1973. 50 pages.

### PB-224 948

The report is intended to be of use to engineers dealing with design, materials, construction, and maintenance of portland cement concrete (PCC) pavement joints. Although much information exists in documented or undocumented form, it is often fragmented or scattered. This discussion covers the advantages of hot-poured asphalt-rubber compound joints in alleviating warping stresses. It includes test roads, sealant research, the functions of joints, design to handle movement and load transfer, thickness, construction of transverse and longitudinal types, problems, preventive maintenance, and current and needed research. Special information is given on bridge approaches. Mathematical analyses, drawings, and photographs are included, plus tabulations of data regarding transverse profiles, sealants, dimensions, mainline and ramp pavements, and subbases.

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# INDUSTRIAL ENGINEERING

## OPTIMUM TARGET SIZES FOR A SEQUENTIAL SAWING PROCESS

Pacific Southwest Forest and Range Experiment Station. H. Dean Claxton. 1972. 15 pages.

### **PB-223 061**

Workers in operations research and systems analysis encounter problems based on sequential process having random components. Raw materials conversion based on a series of cutting operations is one example of this class of problems. Determining the best size setting for each type of saw in the series is a complex decision process that requires consideration of saw characteristics and the loss caused by having the wrong size piece at the end of the process. This paper describes a method of solving this problem. The technique is applicable to a wide range of sequential cutting operations. The cutting of wood pencil blocks is used as an illustration.

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## TECHNICAL PAPERS PRESENTED AT PRACTICAL ENGINEERING WORKSHOPS

West Virginia University, Engineering Experiment Station. D. L. Gochenour, D. A. Chidester, et al. November 1972. 116 pages.

### **PB-225 557**

This document is comprised of three papers intended to be of assistance to practitioners of the industrial engineering profession. The first, "Applied Simulation Techniques," covers the following topics: The simulation process; process generators; optimization of simulation generators; determination of when to stop the simulator; applications of simulation. The paper "Engineering Maintenance—A Profit Oriented Business" summarizes a workshop that was intended to show that when human and material resources are properly applied, a manufacturing facility can become more reliable. "Computer Economics" presents a rapid scheme for selecting, costing out, and verifying a computer system needed for a given mix of programming jobs. This estimation system is considered to be useful for managers who have limited time to spend studying available computer hardware and systems, but who desire an independent estimate of the costs of a new system.

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# MANUFACTURING METHODS

## EVALUATION OF METHODS OF ASSEMBLING PALLETS

Forest Products Laboratory, R. S. Kurtenacker, 1973. 29 pages.

### AD-768 726

The performance of pallets assembled by various methods—with nails, staples, or synthetic elastomeric adhesives—was evaluated testing pallet corners statically and dynamically (impact). In addition to the assembly methods, other variables investigated were species and moisture content at time of assembly. Hardened pallet nails, slightly thinner and shorter than the standard helically threaded pallet nail, performed better than did the standard nail, especially in the impact tests of pallet corners. Results of tests of both the corners and the complete pallet corners. Results of tests of both the corners and the complete pallets confirmed that the slender nails were superior to the standard pallet nail. Pallets assembled with pneumatically driven plastic-coated staples (2.5 in. legs, 15 gage wire) performed adequately as did the pallets assembled with two or four synthetic elastomeric adhesives.

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## APPLIED ULTRASONIC CLEANING AND POWDER DISPERSION

Union Carbide Corp. T. Lee, J. W. Williams, C. W. Weber. August 1973. 33 pages.

### K-1842

The use of ultrasonics in a variety of cleaning and powder applications has resulted in improved results. Some of these applications are described in this report. Proper application of ultrasonics requires an understanding of the design of the equipment, and the basic ultrasonic theory involved. These basics are discussed with orientation toward the applications described. In the sections describing applications, several innovations are included that provide for uniform cleaning without erosion, multiple powder-sample dispersions, and tests of effective cleaning and of complete powder dispersion.

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## **ELECTRON-BEAM WELDING: REVIEW OF LITERATURE**

Cranfield Institute of Technology. W. F. Chambers, and R. L. Apps. June 1972. 21 pages.

**N73-14474**

Electron-beam welding is a comparatively new welding process in which a narrow beam of electrons emitted at the cathode of a high voltage vacuum system is focussed by an electrostatic plate onto the workpiece—the material to be welded—serving as the anode of the system. The report presents the results of a literature review of materials, properties, and thicknesses. Data include metals (and thickness) as follows: Pure aluminum (0.06 to 0.24 in.), aluminum-copper alloys (8 mm and 0.5 in.), aluminum-zinc magnesium alloys (0.5 in.), beryllium (0.25 to 0.75 in.), chromium (1 to 2 mm), pure copper (to 0.03 in.), copper alloys (to 0.10 in.), ferrous alloys except low carbon steels (0.04 to 0.05 in. depending on type), and nickel alloys (0.062 to 0.625 in.). Other metals discussed are magnesium, molybdenum, niobium, tantalum and its alloys, tungsten, uranium, zirconium and dissimilar metals. In addition, references are given for graphite, miniature components, nuclear engineering, aerospace and aeronautical craft, light and medium engineering, and heavy engineering and pipework.

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**Manufacturing  
Methods**  
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# MATERIALS

## HIGH-PERFORMANCE STEEL AND TITANIUM CASTINGS

National Materials Advisory Board. A. Hurlich, T. S. Piwonka, et al. July 1973. 232 pages.

### AD-767 726

High-performance castings are load-carrying structures designed to withstand large stresses and whose service failures could have catastrophic or serious safety or economic consequences. The report outlines requirements for facilities and processes for producing very large castings—up to 20,000 pounds—of special alloy steels and titanium. The present state of foundry technology for production of such castings is assessed. Problems are discussed that are encountered, and programs and approaches are recommended to resolve them. Of specific interest are melting processes, furnaces, casting design, molds and pouring methods, chemical composition, impurities, heat treatment, weld repair, structural joining, scrap reclamation, and procurement requirements.

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## SYNTHETIC ADHESIVES

Army Foreign Science and Technology Center. D. A. Kardashov. 1973. 636 pages. (Translated into English by A. L. Peabody from the monograph *Sinteticheskiye Klei*, Moscow, 1968)

### AD-769 295

This document provides a summary of contemporary experience, throughout the world, in the production, testing, and application of adhesives based on synthetic resins to industry and domestic life. The first section discusses the basic concepts of the mechanism of adhesive bonding. Descriptions of the most important adhesives based on synthetic polymers are followed by presentations of their method of production and their properties. Manufacturing methods and recommended modes of bonding are provided for selected adhesives. The following section deals with the technology of bonding and the use of adhesives. It includes various examples of the use of adhesives for joining of metals and nonmetallic materials in various areas of modern technology. Finally, consideration is given to methods of testing adhesives and adhesive joints.

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## GLASS TECHNOLOGY

Army Foreign Science and Technology Center. L. M. Butt, and V. V. Pollyak. August 1973. 449 pages. (Translated into English from the monograph *Tekhnologiya Stekla*, Moscow, 1971)

### AD-769 470

This monograph provides information on the essentials of making glass and fabricating glass articles, based on experience gained throughout the world. The topics covered include the following: The physical nature of glass and its properties; raw materials and batch preparation; glass melting; manufacture of glass articles; processes for forming glass articles; annealing, tempering, and strengthening; sheet glass; polished glass; laminated and tempered glass; architectural and structural glass; foam glass; glass fiber and glass fiber articles; glass tubing; container glass; quality glass; technical glass; electrotechnical glass; quartz glass; optical glass, mirror production; and production of glass-crystalline articles (i.e., sitalls or pyroceramics).

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## REVIEW OF SILICON NITRIDE

Army European Research Office; and Office of Naval Research. William J. Croft, and Ivan B. Cutler. July 1973. 44 pages.

### AD-769 680

Silicon nitride has generated considerable interest within the past few years as a material with a potential for many high temperature engineering applications. It combines high hardness, low thermal expansion, and strength at high temperatures. This document provides a review of the literature on the subject of silicon nitride. The topics covered include crystallography, thermodynamic data, ceramic processing, physical and chemical properties, and applications.

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## SILICON NITRIDE FOR STRUCTURAL APPLICATIONS—AN ANNOTATED BIBLIOGRAPHY

Army Materials and Mechanics Research Center. Donald R. Messier and Margaret M. Murphy. October 1973. 66 pages.

### AD-770 302

The increasing demand for engineering materials in high-temperature applications has led, in many cases, to the use of ceramics. Silicon nitride, a ceramic material, has outstanding mechanical and chemical properties and resistance to corrosion and to thermal shock. This report summarizes the research and development work accomplished thus far on the fabrication and properties of silicon nitride, particularly as it applies to structural uses of the material. Coverage includes work on reaction sintered and hot-pressed sili-

Materials  
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**Materials**  
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con nitride, as well as on silicon oxynitride and Si-M type oxynitrides having the silicon nitride structure. Whisker growth, chemical reactions, mechanical behavior, and other factors relevant to the processing and applications of silicon nitride are also included.

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**FUNGUSPROOFING. A DDC BIBLIOGRAPHY**

Defense Documentation Center. December 1973. 265 pages.

**AD-771 700**

A bibliography of abstracts dealing with fungusproofing as it pertains to industrial processing is provided. The subjects of weatherproofing, coating, moisture-proofing, fungus deterioration, and fungicides are all included. The period covered is 1953-73. Subject and author indexes are included. The reports listed in this bibliography are available from NTIS.

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**ELEVENTH BIENNIAL CONFERENCE ON CARBON**

American Carbon Committee; and Oak Ridge National Laboratory. June 1973. 373 pages.

**CONF-73061**

This document is comprised of summaries of papers contributed to an international conference on carbon held in June 1973. Each summary is from one to two double-column pages in length and includes all tabular and graphic material submitted with the original paper. The general subject matter covered includes: Electronic properties; carbonization and graphitization; pyrolytics; thermal properties; diffusion; cokes; fabrication; sorption; chemical reactivity; precursor chemistry; applications; optical anisotropy; mechanical properties; intercalation compounds; structural studies; fibers and composites; nuclear graphite.

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# METROLOGY & TESTING

## NONDESTRUCTIVE TESTING: RADIOGRAPHY.

### A DDC BIBLIOGRAPHY

Defense Documentation Center. November 1973. 131 pages.

#### AD-769 100

The bibliography is a compilation of abstracts on radiography as used in nondestructive testing. References pertain to radiographic techniques for use in inspection and evaluation of electronic parts, metal fatigue, and filament wound materials. Attention is given to steels and other alloys, optical properties, lasers and microwaves, rocketry, mathematical analysis, and industrial research. Subject and author indexes are included. The reports listed in this bibliography are available from NTIS. (This report supersedes a previous edition, AD-733 860, which was announced in AMTID, July 1972, page 61.)

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## NONDESTRUCTIVE TESTING: ULTRASONICS.

### A DDC BIBLIOGRAPHY

Defense Documentation Center. November 1973. 193 pages.

#### AD-769 200

This bibliography is comprised of abstracts dealing with ultrasonic techniques for inspection of welds, thickness measurements, flaw detection, evaluation and characterization of materials, and fatigue damage and crack detection. Coverage includes steels, ceramic materials, alloys, coatings, wood, and painted surfaces. Methodology includes neutron activation, laser techniques, wave propagation, and integrated circuits. Some attention is given to acoustic holography, microwaves, and instrumentation. Subject and author indexes are included. The reports cited in this bibliography are available from NTIS. (This document supersedes an earlier edition, AD-733 700, which was announced in AMTID, July 1972, page 60.)

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## **A LOAD CALIBRATION TECHNIQUE FOR USE ON LARGE INDUSTRIAL PRESSES AND SMALL TESTING MACHINES**

Westinghouse Electric Corp. V. DePierre, S. O. Davis, and F. J. Gurney. June 1973. 30 pages.

### **AD-769 265**

Load calibration of large industrial presses can offer economic advantages in production operations by allowing the capacity of the press to be mated to the forming process and the tooling design. Knowledge of processing loads occurring during production operations can allow judgments to be made regarding the selection of the interface lubricant, the number of preforming operations required, and the basic die design. This document describes a new load calibration technique based on the plastic deformation of a ring specimen. The method, which is simple, reproducible, and accurate, provides the following advantages: (1) it allows calibration of any size press over its full capacity range; (2) it can be used equally well on hydraulic or mechanical presses; (3) it does not require extrapolation of low load data to higher load regions and, therefore, its accuracy at the high load regions is not affected.

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## **NONDESTRUCTIVE TESTING: METHODS, TECHNIQUES, AND THEIR APPLICATIONS. A DDC BIBLIOGRAPHY**

Defense Documentation Center. November 1973. 279 pages.

### **AD-769 450**

This bibliography contains abstracts of reports in the field of nondestructive testing. The period covered is January 1964 thru June 1973. Some of the methods and techniques that the reports deal with are electromagnetic, eddy current, holography, magnetic, photoplasticity, optical correcation, and light scattering. Also considered are flaw detection, fatigue damage, thickness measurement, inspection techniques, crack detection, and materials characterization. A subject index is included. The reports cited in this bibliography are available from NTIS. (This document supersedes an earlier edition, AD-733 850, which was announced in AMTID, July 1972, page 60).

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## **NATIONAL PROGRAM OF METROLOGY FOR ECUADOR**

National Bureau of Standards, Office of Engineering and Information Processing Standards. T. M. Stabler. April 1973. 33 pages.

### **COM-74-10394**

The Ecuadorian Institute for Standardization (INEN) was established in 1971 to promote the development of a centralized system of standards. Its basic function involves the preparation and publication of compulsory and voluntary standards relating to practices, processes, materials, products, and commodities. INEN also has the responsibility for developing a weights and measures program in Ecuador. In this connection, an adviser from the US National Bureau of Standards was engaged to assist in the planning of a program of scientific and legal metrology. This document contains the program plan developed as a result of this effort.

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### **REPORT TO AID ON AN NBS/AID WORKSHOP ON STANDARDIZATION AND MEASUREMENT SERVICES IN INDUSTRIALIZING ECONOMIES**

National Bureau of Standards, Office of International Relations.  
May 1973. 65 pages.

#### **COM-74-10396**

For several years, the US Agency for International Development and the National Bureau of Standards have had a cooperative program designed to facilitate the industrialization of various countries by helping them to develop a measurement and standards infrastructure. One of the important elements of this program is a series of annual workshops. This document covers the second of these workshops, which was held in May 1973. The workshop was attended by standards specialists from Bolivia, Brazil, Ghana, Kenya, Republic of Korea, Malaysia, Nigeria, and Republic of Viet-Nam. Descriptions of measurements and standards activities in Korea, Viet-Nam, Bolivia, and Kenya are included in this report. Also included is a paper dealing with statistical aids to economic production.

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### **RADIOMETRIC GAGES: A BIBLIOGRAPHY**

Atomic Energy Commission, Technical Information Center. W. Hugh Kinser. January 1974. 126 pages.

#### **TID-3338**

Radiometric gages have important applications in industry, hydrology, civil engineering, and the laboratory. This bibliography contains abstracts of 794 articles, reports, patents, and monographs dealing with the design, operation, and uses of these devices. The abstracts are grouped according to functional type of gage: dosimeters and balances, level indicators and fuel gages, moisture gages, soil moisture gages and density meters, thickness gages, and other radiometric gages. Most of the sources were published during the 1967-73 period. Subject and author indexes are included.

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# **MINING & MINERALS INDUSTRIES**

## **REMOVING PYRITE FROM COAL BY DRY SEPARATION METHODS**

Bureau of Mines, Morgantown Energy Research Center. William T. Abel, M. Zulkoski, et al. 1973. 30 pages.

**PB-221 627**

A major problem of coal burning plants for electric power generation is reducing air pollution from the stack gases. A chief pollutant is sulfur dioxide that results from oxidation of iron disulfide (pyrite) present in the coal. Since sulfur dioxide removal is expensive and pyrite is not chemically bound to the coal, it is highly desirable to remove as much of the sulfur-containing components as possible prior to combustion. An experimental dry process is reported for separating pyrite from coal pulverized to powerplant fineness, involving two steps: centrifugal action to remove a fine, pyrite-depleted portion of the coal, and electrostatic separation of the remaining coarser pyrite-enriched portion to concentrate and reject the pyrite. A detailed description is given of the methodology and equipment, and the results are discussed for effectiveness and further development. The advantages obtainable over the presently employed wet processing techniques are pointed out.

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## **TECHNOLOGIC AND RELATED TRENDS IN THE MINERAL INDUSTRIES, 1972**

Bureau of Mines. 1973. 50 pages.

**PB-221 841**

Recent trends and developments in the minerals industry are examined, particularly new methods, equipment, techniques, and systems to more effectively extract and process minerals and fuels. Some of the areas covered include: Exploration; trends in coal, copper, and iron mining; drilling, blasting, machine excavation and other fragmentation techniques; ground support and control; material handling and transportation; petroleum and natural gas production; copper, iron ore, lead-zinc, cement, clay, phosphate rock, sand and gravel, stone, and coal productivity; trends in beneficiation, hydrometallurgy, electrometallurgy, and

pyrometallurgy; recycling, waste treatment, and environmental control; energy product utilization via coal liquefaction, coal gasification, carbonization, fluidizedbed combustion, combined-cycle power generation, magnetohydrodynamics, and alternative fuels; and health and safety.

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**Mining & Minerals  
Industry**  
(continued)

## **MAKING VENTILATION-PRESSURE SURVEYS WITH ALTIMETERS**

Bureau of Mines. G. E. McElroy, and D. S. Kingery. October 1957. 23 pages.

**PB-222 086**

Ventilation-pressure surveys are required to determine the rates of pressure losses in various parts of a mine-airway system. To plan improvements in the system according to engineering practice rather than by past trial and error methods, complete information must be obtained on quantity flow around the system and on the rates at which pressures produced by fans and natural draft are used up. The report discusses the use of an altimeter—a form of aneroid barometer—for making pressure surveys to pinpoint bottlenecks and to indicate methods of improvement in the ventilation system. Two specific instruments are described, preliminary planning is outlined, and the survey methodology is given. In either of two procedures two altimeters may be used. In one case simultaneous readings are made at two stations, the rear observer then moving past his companion to the next station forward and simultaneous readings taken again. In the other, a base is established for one instrument and synchronized timed readings are made at short time intervals while readings are taken at successive stations on the other. An anemometer is used to measure airflow and a wet and dry bulb psychrometer gives a measure of humidity. Advantages of the portable equipment are noted, along with the problem of converting an inverted nonlinear pressure scale.

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## **EVALUATION OF PRESENT SHOTCRETE TECHNOLOGY FOR IMPROVED COAL MINE GROUND CONTROL**

Illinois Institute of Technology Research Institute. S. A. Bortz, E. Aleshin, et al. May 1973. 219 pages.

**PB-222 872**

A major problem in underground coal mines is that falls occur from the roof, rib, or face. Several types of temporary or permanent roof supports have been used to alleviate this problem, but all have deficiencies. Shotcrete, a pneumatically sprayed concrete, offers a new solution to the problem. The concrete is deposited on a prepared surface with considerable force, applicable to vertical, overhead, or horizontal surfaces. It is deposited in layers,

various thicknesses being obtained by successive applications. Adhesion between these layers enables them to be practically integral with one another. The report presents the results of an extensive laboratory testing program to determine the physical properties of shotcrete, including the use of fast setting agents, controlled-set cements, and both wet and dry processes. Physical properties were measured, and mechanical properties were determined. The results demonstrate that rapid setting shotcrete has the potential for improved coal mine ground control.

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### **METAL CONTENT OF FERROMANGANESE DEPOSITS OF THE OCEANS**

Columbia University, Lamont-Doherty Geological Observatory.  
D. R. Horn, M. N. Delach and B. M. Horn. 1973. 82 pages.

#### **PB-223 083**

This document provides a compilation of published and unpublished chemical analysis of samples of ferromanganese deposits from the ocean floor. The data are tabulated according to exact location in latitude and longitude, depth or deposit, analytical method, and weight percent of nickel, copper, cobalt, iron, manganese, silicon, and calcium. Inspection of the results indicates that the highest values of copper and nickel of any nodular deposit in the world ocean occur in a band of the Pacific Ocean lying between 6° 30'N and 20°N and extending from 110°W and 180°W. This region, therefore, offers the most promise to ocean miners.

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### **OCEAN MANGANESE NODULES: METAL VALUES AND MINING SITES**

Colombia University, Lamont-Doherty Geological Observatory.  
D. R. Horn, B. M. Horn, and M. N. Delach. 1973. 64 pages.

#### **PB-223 130**

This document provides an outline of the main ferromanganese provinces of the world ocean and indicates their potential as future research and mining sites. It begins with a review of the history of the discovery and determination of the ranges of the provinces of nodules. Consideration is then given to areas outside the North Pacific that possess large deposits of ferromanganese but where metal values are too low for commercial exploitation. The high-density Cu-Ni rich deposits of the North Pacific are discussed in some detail. Finally, potential sites for academic study and mining activity are suggested.

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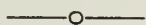
## **INTERUNIVERSITY PROGRAM OF RESEARCH ON FERROMANGANESE DEPOSITS OF THE OCEAN FLOOR**

Mining & Minerals  
Industry  
(continued)

National Science Foundation, Seabed Assessment Program. April 1973. 363 pages.

### **PB-223 156**

This document is comprised of papers submitted by workers from 13 institutions in an effort to establish a baseline of the current state of knowledge of manganese nodules on the ocean floor. The topics covered include the following: Major and minor elemental composition of manganese nodules; rare-earth elements in ferromanganese nodules; mineralogical, chemical, and optical procedures and standards for study of growth features and economic potential of manganese nodules; analytical techniques to obtain spectroscopic characterization of manganese nodules; infrared microanalysis for deducing the formation history of manganese nodules; microlaminations in marine manganese nodules as revealed by scanning electron microscopy; microprobe analysis of manganese crusts from the Hawaiian Archipelago; accumulation rates of manganese crusts on rocks exposed on the sea floor; precipitation of manganese oxide in deep sea sediments; geochemistry of ferromanganese crusts, manganese carbonate crusts, and associated ferromanganese nodules for Lake Michigan; manganese deposits in the Southwest Pacific; investigations of manganese nodules from the Southwest Indian Ocean; survey of a manganese nodule region in the North Atlantic Ocean; biology of ferromanganese nodules; impact of manganese nodule mining on the seabed and water column; adsorption of dissolved organic compounds from seawater onto sediment and manganese nodule particles; trace element additions to seawater resulting from contact with ferromanganese nodule particles; technological gaps in exploration of marine ferromanganese deposits; the changing law of sea-mining; economic evaluation of a ferromanganese deposit.



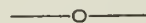
## **GOB PILE STABILIZATION, RECLAMATION, AND UTILIZATION**

West Virginia University, Coal Research Bureau. Jerry L. Coalgate, David J. Akers, and Russell W. Frum. May 1973. 138 pages.

### **PB-224 561**

The extraction of minerals is generally accompanied by the problem of disposal of tremendous volumes of waste. In the case of gob piles (i.e., refuse piles or culm banks) resulting from coal mining, the problem is one of basically nonproductive use of land, loss of aesthetic value, possible slides, and air and water

pollution. Gob piles are essential out of equilibrium with their environment; the production of acid water, slides, and fires are all symptoms of this disequilibrium. To stabilize a gob pile, two approaches or combinations of two approaches may be used. One approach is to hasten the readjustment of the material to surface conditions and the other is to prevent the readjustment (in effect insulate the gob pile from its environment). This report is intended to show what progress has been made to date in the area of stabilization, reclamation, and utilization of gob piles. The first part is a discussion of the types of dangers and pollutants associated with refuse piles. The remaining parts bring together the various solutions that have been brought to bear on the problem.



# **PUBLIC HEALTH**

## **MOSQUITO CONTROL. SOME PERSPECTIVES FOR DEVELOPING COUNTRIES**

National Academy of Sciences, Board on Science and Technology for International Development. A. R. Barr, K. L. Knight, et al. March 1973. 74 pages.

**PB-224 749**

There are many approaches to mosquito control other than those in widespread use today that are worth considering for future use, particularly in view of the growing uncertainty about the overall effects of chemical pesticides. This report considers nine of these possible approaches in some detail. These are: larvivorous fish, invertebrate predators, genetic control, parasitic nematodes, parasitic protozoans, parasitic fungi, pathogenic bacteria, juvenile hormone mimics (insect growth regulators), and larvicidal plants. Some of these methods are almost ready for widespread application; for others, the fundamental principles are still being developed. The intent is not to provide a technical handbook but, rather, to arouse interest in some unusual but promising mosquito-control methods that might otherwise be ignored. Summaries in French and Spanish are included.

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## **HEALTH PLANNING: QUALITATIVE ASPECTS AND QUANTITATIVE TECHNIQUES**

Johns Hopkins University, Department of International Health. William A. Reinke, and Kathleen N. Williams (Eds.). 1972. 355 pages.

**PB-225 514**

Public health planning has advanced from an intuitive or subjective projection based mainly on past experience to a more deliberate, systematic, and objective process based on information mobilization and resource organizing. The report considers the planning structure, in which the policy-making body represents the political power structure, the general public, and health pro-



**Public Health**  
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professionals. The balance among these three groups is determined largely by the type of planning involved. The first stage thus consists of planning and developing planning competence. The second stage includes making policy statements and outlining broad goals, with the planner careful not to impose his own predilections on the process. Next is reliable data gathering. Following are determination of priorities, studying alternatives, formulating a detailed plan with targets and standards, getting the plan accepted, and evaluating the results. This health planning base must include political aspects, general economic considerations, the demographic base, and attention to epidemiology. Some specific methods are noted for plan development, and some categories requiring special consideration are discussed, such as mental health, environmental problems, and family planning.

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# REMOTE SENSING

## PROCEEDINGS OF THE EIGHTH INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT. VOL. 2

Environmental Research Institute of Michigan, Center for Remote Sensing Information and Analysis. April 1973. 771 pages.

**AD-770 489**

This document is comprised of papers presented at a symposium on remote sensing that was held at Ann Arbor, Michigan, in October 1972. Volume 2 contains more than 50 papers covering the following general subject area: Interpretation of multispectral imagery; sensing and analysis of coastal waters; remote sensing as an aid to geologic mapping; remote sensing of vegetation; analysis and utilization of data from ERTS-1. Volume 1 of these proceedings is described in the November 1973 issue of AMTID, page 87. (Note: the reproductions of photographs in this document are of poor quality.)

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## INTRODUCTION TO BASIC REMOTE SENSING FOR ENGINEERING GEOLOGISTS

University of Illinois. Peter J. Tarkoy. 1971. 174 pages.

**PB-224 754**

This document presents a technical discussion of the theory of the electromagnetic spectrum as it relates to remote sensors, describes the bands and sensors used in remote sensing, and relates how these remote sensors can be useful in engineering geology and geological exploration. There is a discussion of what each sensor can do and what its most useful application is. A fairly extensive bibliography is included, and extended abstracts are provided for the more important citations.

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# **SAFETY ENGINEERING**

## **FIRE RESEARCH ABSTRACTS AND REVIEWS**

National Academy of Sciences, Division of Engineering and Industrial Research. Walter G. Beal, Editor.

This series brings together widely scattered scientific studies on fires and fire prevention. Each volume contains several review articles, plus abstracts of the literature. The abstracts cover the following general topics; ignition phenomena; thermal decomposition; heat and material transfer; diffusion flames; combustion principles; radiation; suppression of combustion; model studies and scaling laws; atomization of liquids; meteorological interactions; operational research principles applied to fire research; instrumentation; fire-fighting techniques, equipment design, and materials of construction. The individual volumes are as follows:

<b>AD-769 522</b>	Vol. 1, 1959. 280 pages.
<b>AD-769 523</b>	Vol. 2, 1960. 207 pages.
<b>AD-769 524</b>	Vol. 3, 1961. 141 pages.
<b>AD-769 525</b>	Vol. 4, 1962. 269 pages.
<b>AD-769 526</b>	Vol. 5, 1963. 257 pages.
<b>AD-769 527</b>	Vol. 6, 1964. 332 pages.
<b>AD-769 528</b>	Vol. 7, 1965. 263 pages.
<b>AD-769 529</b>	Vol. 8, 1966. 298 pages.
<b>AD-769 530</b>	Vol. 9, 1967. 313 pages.
<b>AD-769 531</b>	Vol. 10, 1968. 400 pages.
<b>AD-769 532</b>	Vol. 11, 1969. 330 pages.
<b>AD-769 533</b>	Vol. 12, 1970. 320 pages.
<b>AD-769 534</b>	Cumulative index, Vols. 1-9, 1958-67. 56 p.

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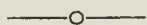
# **SCIENCE POLICY & RESEARCH PROGRAM MANAGEMENT**

## **COLLABORATIVE RESEARCH PROGRAM BETWEEN NBS AND INDIAN SCIENTIFIC INSTITUTIONS. SPECIAL FOREIGN CURRENCY PROGRAM, 1973 STATUS**

National Bureau of Standards, Office of International Relations.  
H. Steffen Peiser, Michael B. McNeil, and Doris M. Bluebond.  
November 1973. 141 pages.

### **COM-73-50930**

For several years the National Bureau of Standards has collaborated with technical institutions in India through research projects conducted largely in Indian institutions. An overview is given of grants awarded under the Special Foreign Currency Program, each grant being identified by title, principal investigator, Indian institution, NBS monitor, and the monitor's organizational unit within NBS. The work is described under project goals, results to date, and publications produced. A high benefit to cost ratio is observed. Examples of the investigations are ultrasonic dispersion, high pressure techniques, electrolytes in nonaqueous media, alloy properties, infrared properties, metal oxides, molecular spectra, ferroalloy standards, and catalytic processes.



## **AN ANALYTICAL PROCEDURE TO ASSIST DECISION MAKING IN A GOVERNMENT RESEARCH ORGANIZATION**

Pacific Southwest Forest and Range Experiment Station. H. Dean Claxton and Giuseppe Rensi. 1972. 20 pages.

### **PB-223 060**

Evaluating proposals for inclusion in a research program is an important, continuing, and difficult process for the research administrator. He usually decides on the basis of intuition and knowledge. Typically, only a small amount of data and analysis are available to him before proposals are selected and molded into a research program. This paper describes an analytical procedure to assist in a decision-making problem of this type. A conceptual framework is proposed in which objectives, activities,

and constraints of a government research organization are considered in a functional systematic manner. Methodology, theoretical constructs, and empirical propositions from economics, operations research, and mathematical programming are used in developing the proposed procedure and substantiating its results.

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**WORKSHOP ON THE ROLE OF THE COUNCIL FOR  
SCIENTIFIC AND INDUSTRIAL RESEARCH IN  
DETERMINING SCIENCE POLICY AND  
RESEARCH PRIORITIES, 18-31 MARCH 1973**

Ghana Council for Scientific and Industrial Research; University of Ghana; and National Academy of Sciences. May 1973. 65 pages.

**PB-224 937**

Scientific research is used as a major tool for national economic and social development. This report reviews the role of the Council for Scientific and Industrial Research (CSIR) and recommends how CSIR should carry out its responsibilities for the national improvement of Ghana. Science policy and research priorities are considered in relation to problems of developing agriculture, business, industry, and education in Ghana.

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**STRENGTHENING CAPABILITIES OF DEVELOPING  
COUNTRIES TO ACQUIRE, PROCESS, AND  
UTILIZE INFORMATION ABOUT OCEAN RESOURCES**

National Oceanographic Data Center. Rene Cuzon Du Rest. December 1973. 62 pages.

**PB-227 449**

Knowledge of the oceans off the shores of developing countries is becoming increasingly important to the countries themselves and the oceanographic community as a whole. A better understanding of ocean resources requires training and international cooperation, particularly in the acquisitions, processing, and use of oceanographic data. In an effort to explore ways of meeting this need, an experimental demonstration course was established. This document provides a record of the experiment, which may prove useful to institutions that might wish to conduct a similar program of training.

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## **PROGRAM ON POLICIES FOR SCIENCE AND TECHNOLOGY IN DEVELOPING NATIONS**

Cornell University. November 1972. 48 pages.

Science Policy &  
Research Program  
Management  
(continued)

### **PB-227 683**

This report provides a summary of activities associated with the first year (August 1971–August 1972) of a program concerned with the role of science and technology in developing nations. The program also sought to identify and evaluate alternative policies for science and technology that might be implemented at national and regional levels to promote social and economic development of less developed countries. The objectives of the program, its accomplishments, and future activities are discussed.

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## **SOCIAL SCIENCES**

### **A FAMILY PLANNING HYPOTHESIS: SOME EMPIRICAL EVIDENCE FROM PUERTO RICO**

Rand Corp. T. Paul Schultz. December 1967. 85 pages.

**AD-662 865**

A problem critical to the economic development of a less developed country is that of population control. Although convenient, cheap, and abundant birth control devices have often been regarded as the solution to the population problem, this may be only part of the solution, since parents may continue to want more children. This neglected possibility is explored in the report, with particular reference to Puerto Rico. If differences in birth rates reflect differences in the desire for births, the aspects of the parents' environment that are responsible need investigation. A study is made of birth-rate determinants, including behavior alteration, environmental betterment, and new limitations as the result of economic change. A hypothesis for family planning is presented, involving the inertia of human behavior, imperfect information, and the incessancy of change. No survey of the literature on demography, sociology, and anthropology is included. The hypothesis is developed on the basis of (a) family size goals determined by the environment, (b) incidence of death among offspring, and (c) the effect of uncertainty in the family formation process. The implications are tested by empirical evidence from Puerto Rico, including the economic activity of women and children.

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### **THE PHILIPPINE FAMILY PLANNING PROGRAM: SOME SUGGESTIONS FOR DEALING WITH UNCERTAINTIES**

Rand Corp. John E. Koehler. February 1970. 36 pages.

**AD-703 278**

In the Philippines, as in other developing countries, basic information about social structures, patterns of communication, economic activities, and even demographic change is scarce. The lack of such information makes it difficult to develop or evaluate family planning programs. Firm answers are lacking on basic questions, such as how fast the population is growing, how wide-

spread family planning is, how knowledge and use varies across the country, what distinguishes contraceptive users from nonusers, and where women learn about contraception. The answers are at once uncertain and fundamental to program effectiveness. The report attempts to define better some of the uncertainties of family planning in the Philippines and to bring to bear new data relevant to program design. A few tentative conclusions are reached: Some apparent assumptions underlying the program may be false; some risks can be avoided at low cost; and uniform record-keeping in the clinics can bring important benefits to the program. The discussion centers around some answers to the five questions enumerated with regard to the Philippines.

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### **A CRISIS OF AMBIGUITY: POLITICAL ECONOMIC DEVELOPMENT IN THE PHILIPPINES**

Rand Corp. H. A. Averch, F. H. Denton, and J. E. Koehler. January 1970. 342 pages.

#### **AD-703 375**

The report stems from a general notion that the Philippines suffer from unsatisfactory economic growth, increasing crime and corruption, the menace of insurgency, and irrelevant politics, leading to a questionable democratic stability. Survey results, however, indicate that such conclusions are based mainly on misapprehensions. The nation is seen to have problems, and national decision makers appear to require improved policies, but an improvement in environmental understanding and an improved information system must lead to better performance. Some steps in this direction are outlined. First is an acquisition of knowledge as to the patterns of social and economic structures over time. A factor analysis method is described toward this end. The ensuing discussion covers crime distribution, dissidence and discontent, political criteria and voting habits, inaccurate economic perceptions regarding unemployment and stability, and attitudes of the rural population in particular. The text is divided into quantitative historical analysis, perceptions of the social system, and political factor surveys.

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### **AREA HANDBOOK FOR NEPAL, BHUTAN, AND SIKKIM. SECOND EDITION**

American University. G. L. Harris, J. A. Giddens, et al. 1973. 487 pages.

#### **AD-769 519**

This handbook is intended to provide a convenient compilation of basic facts about the social, economic, political, and military institutions and practices in the Kingdoms of Nepal and Bhutan and the Indian Protectorate of Sikkim. For each of the countries, information is provided on the following topics where applicable

and available: General character of the society; historical setting; geography and population; ethnic groups and languages; family and social structure; health and welfare; education; artistic and intellectual expression; religion; social values; government organization; political dynamics; foreign relations; public information; political attitudes of the populace; character and structure of the economy; agriculture; labor; industry and trade; financial and monetary system; public order and internal security; armed forces. Extensive bibliographic listings are included.

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#### **AREA HANDBOOK FOR IVORY COAST. SECOND EDITION**

American University. T. D. Roberts, Benjamin Nimer, et al. 1973. 498 pages.

#### **AD-769 536**

This handbook is intended to provide a convenient compilation of basic facts about the social, economic, political, and military institutions in the Republic of Ivory Coast. The emphasis is on description of the nation's present society and the kinds of changes that might be expected in the future. Some of the more specific subjects covered are: General character of the society; history; geography and population; ethnic groups and languages; family; social structure; educational and intellectual expression; religion; artistic expression; health and welfare; social values and patterns of living; constitution and government; political dynamics; foreign policy; information and propaganda; attitudes and reactions of the people; character and structure of the economy; industry; labor; domestic and foreign trade; financial system; public order and internal security; armed forces.

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#### **AREA HANDBOOK FOR THE DOMINICAN REPUBLIC. SECOND EDITION**

American University. T. E. Weil, J. K. Black, et al. 1973. 265 pages.

#### **AD-770 086**

This is a compact and objective exposition and analysis of the dominant social, political, and economic characteristics of the Dominican Republic. It is based on information available in openly published literature. The subject areas covered include: General character of the society; geography and population; historical setting; social system; living conditions; education; cultural life; public information; government; political dynamics; foreign relations; character and structure of the economy; agriculture; industry; trade; national defense and public order. An extensive bibliography is included.

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## UNEMPLOYMENT AS A SOCIAL-WELFARE PROBLEM IN URBAN ZAIRE

Yale University, Economic Growth Center. James L. McCabe.  
November 1972. 30 pages.

**PB-219 722**

In common with other developing nations on the African continent, Zaire is experiencing an essentially urban unemployment problem. At the same time a labor shortage is observed in agriculture. The report discusses the employment-social welfare picture of the nation, involving two important characteristics. The first is a form of nonwage employment, comprising mainly female activities in agricultural production, retailing, and other fields. The second is individual sharing units centered about the immediate family but extending beyond it a considerable way. Main attention is devoted to the city of Kinshasa. It is shown that households with high open unemployment rates tend to cluster with households with low open unemployment rates. Tabulated data are given for occupational groups, such as white collar, skilled, semi-skilled, unskilled, women, and independents. Other tabulations include information on migrants, the particular commune of St. Jean, and mobility over time. At the same time the distribution of real urban income per sharing unit appears to exceed that of other less developed countries with equal unemployment rates.

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Social Sciences  
(continued)

# TRANSPORTATION

## A METHOD OF SELECTING PORTS OF ENTRY FOR A DEVELOPING COUNTRY

Naval Postgraduate School. Renato Torralba Domingo. September 1973. 39 pages.

**AD-769 692**

A mathematical approach is applied to entry port planning by a developing country which relies extensively on its maritime fleet as a principal means of transporting goods between its own different regions. The problem is stated as follows: (a) Country *p* imports goods through a subset of its total ports, this subset being the ports of entry. (b) Some ports of entry have become inadequate to handle both domestic and international transport. (c) Country *p* must increase the ports of entry but remain within its budget limits. (d) Selection of the new facilities must be optimized. The report presents the development of an algorithm for rigorous treatment of the problem, with a constraint on the number of port sources used. Constant costs and number of ports are used in the formulation. The algorithm initially considers all ports in the system as candidates for final choice, and proceeds by eliminating from consideration one port at a time until the required number is attained. Although some nonoptimal results may be yielded, the solution appears better than other possible solutions.

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## THE APRON-TERMINAL COMPLEX: ANALYSIS OF CONCEPTS FOR EVALUATION OF TERMINAL BUILDINGS

Ralph M. Parsons. September 1973. 156 pages.

**AD-771 186**

An effort is made in this report to identify the principal considerations involved in planning the airport apron-terminal area and to arrange these in a single analytical framework. The apron-terminal area is defined as the area limited by the curb on the landside of an airport and the taxiway access to the apron on the airside. Four basic concepts are considered. The pier concepts has a terminal interface such that aircraft are parked in parallel or perpendicular position on either side of a central connector to

the building. The satellite concept consists of a central building surrounded by radially or parallel parked aircraft. In the linear concept the aircraft are parked on the apron in a line of parallel, perpendicular, or angled positions. The transporter concept locates the aircraft remotely from the terminal building, connection to the terminal being provided by vehicular transport. One- or two-level concourses are located in the terminal. The four concepts are analyzed and evaluated for suitability to specific airport situations, based primarily on traffic volume, physical limitations, and station characteristics. Tabular and graphic data are included to aid in evaluating these concepts. Factors in the development process are data collection, cost effectiveness, and service functions.

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**Transportation**  
(continued)

**GOVERNMENT CONTROLS ON TRANSPORT:  
AN AFRICAN CASE**

Brookings Institution, Transport Research Program. Edwin T. Haefele, and Eleanor B. Steinberg. December 1965. 112 pages.

**PB-219 662**

An important factor in determining the need for new transport investment in emerging nations is the degree of use of existing facilities. Use is affected by the various kinds of governmental restrictions; where facilities are shared by nations as in much of Africa, the governmental controls become more complicated, subject to international politics as well as national economics. This monogram deals with the institutions, policies, and controls that determine certain transport patterns (particularly railroad), in south central Africa. Within the area are both newly independent nations and lands still held by colonial powers, operating under government control established for narrow problems with little regard for long-term needs or economic development. Chapter headings include background patterns for Rhodesia, Congo, Angola, Mozambique, and Tanganyika railways; the implications of recent political changes; improved use of rail facilities; rail pricing policy; new rail investments; and transport regionalism on the African continent. Agreements and conventions are described.

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**TRANSPORT AND ECONOMIC DEVELOPMENT**

Brookings Institution, Transport Research Program. Gary Fromm (Ed.). 1965. 317 pages.

**PB-219 901**

Technicians and policy makers alike recognize the importance of transport as an instrument of economic progress, but they often lack the tools for making investment decisions that will serve economic development without allocating too large or small a share of national income to the transport sector. This book is



comprised of a series of essays that provide theoretical insights and analyses of experience that should be useful in such planning. The subject matter covered includes: An approach to transportation investment decisions; objectives of transportation policy; characteristics of transport modes; introducing effective technological advances within the transport sector; design of the transport sector; models of economic development and regional growth; role of transportation policy in economic development in the USSR; equalization of regional development policies; economic evaluation of transport projects in developing countries; pricing transport services; financing transport development; aspects of the decision to build a state-owned railway from the point of view of experience in Chile; selected bibliography on transportation and economic development.

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#### **TECHNIQUES OF TRANSPORT PLANNING. VOL. 1: PRICING AND PROJECT EVALUATION**

Brookings Institution, Transport Research Program. John R. Meyer, and Mahlon R. Straszheim. 1971. 348 pages.

##### **PB-219 925**

The importance of transportation to economic development has long been recognized but seldom defined. This two-volume publication considers transportation as requiring the application of principles drawn from economic theory, decision theory, engineering, and systems analysis in a context broad enough to accommodate political and social factors. Volume 1 brings together the theories of transport pricing, welfare economics, and cost benefit analysis, and surveys the literature of planning as applied to transportation projects. Using a project in Colombia as an example, an analysis is made of the special problems of evaluating large investments in transport facilities, and a systematic procedure is developed that accounts for social as well as economic considerations. Particular cost concepts are outlined, demand forecasting is discussed, and an outline is drawn for procedures in decision making.

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#### **TECHNIQUES OF TRANSPORT PLANNING. VOL. 2: SYSTEMS ANALYSIS AND SIMULATION MODELS**

Brookings Institution, Transportation Research Program. David T. Kresge, and Paul O. Roberts. 1971. 234 pages.

##### **PB-219 931**

The second volume of a two-volume publication on transportation planning as related to economic development applies the principles discussed in Vol. 1 to problems in the developing nation of Colombia. A macroeconomic model is developed to simulate the planning process, mathematical expressions are derived and discussed, and systems analysis is used to coordinate

the results. Empirical data were obtained for the Colombian transport system as a whole, so the analysis can take into account the economic changes likely to result from the implementation of individual transport projects. For example, the effects may be predicted from shifting the level and spatial patterns of economic activity. The two volumes are expected to be of value to public planning authorities, engineers, systems analysts, and government officials in developing countries.

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Transportation  
(continued)

## THE IMPACT OF HIGHWAY INVESTMENT ON DEVELOPMENT

Brookings Institution, Transport Research Program. George W. Wilson, Barbara R. Bergmann, et al. 1966. 235 pages.

### PB-219 930

From case studies of eleven different highways or highway systems in underdeveloped countries, a theory of transport investment and development is suggested. On-the-spot investigations were conducted in Bolivia, Guatemala, and El Salvadore; and data were obtained from eight other transport projects. The highways were all built recently, pass through sparsely populated regions, and have had widely varying economic impacts. It is concluded that development results from a cluster of changes, so that improved transport by itself cannot remedy a nation's economic ills. The improvement may serve as a catalyst for economic growth provided other economic, social, and political elements are present. Such elements need to be recognized and included in transport planning. The chapter headings include the Cochabamba-Santa Cruz highway in Bolivia, the Atlantic highway in Guatemala, the Littoral highway in El Salvador, cases of highway impact in Thailand, India, North Borneo, Nicaragua, Peru, Venezuela, and Uganda; a critique of concepts and approaches; what the cases show, and progress toward a theory of transport and development.

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## THE INTERNATIONAL AIRLINE INDUSTRY

Brookings Institution, Transport Research Program. Mahlon R. Straszheim. 1969. 310 pages.

### PB-219 943

The airline industry has been one of the fastest growing and most technologically advanced of all international industries, but the rapid expansion has created problems. Some new carriers of marginal efficiency have sustained setbacks, particularly during the transition from piston to jet propulsion in the 1960's. The reasons for mixed performance in the industry are analyzed, with an especial attention to management practices and government policies. Problems and potentials of commercial air operations

are examined for countries in various stages of economic development. Prospects are discussed for economic improvement, and some recommendations on policies are made. Chapter topics include government motives and influences; entry conditions such as processes and restrictions; input markets and the production function; costs; demand; pricing; economic efficiency; industry performance vs. structure; recommendations for policy; and forecasts for the future.

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## **PROCEEDINGS: 1972 NATIONAL CONFERENCE ON RAILROAD-HIGHWAY GRADE CROSSING SAFETY**

Ohio State University. August 1972. 76 pages.

### **PB-222 882**

This document is comprised of papers and addresses given at a symposium, held in August 1972, which was intended to provide a forum for the discussion of new ways and means to ensure increased safety and to achieve optimum efficiency in the use of both highway and railroad facilities. Some of the topics covered are as follows: Benefits and problems involved in urban railroad relocation urban rail planning; train activated rail highway protection; grade-crossing safety responsibilities; passive warning devices at railroad-highway grade crossings; implementation problems relating to a rail-highway grade crossing safety program; engineering and economic warrants for the installation of grade crossing protective devices; maintenance of automatic highway crossing signals and gates at grade intersections.

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## **HIGHWAY EMERGENCY LIGHT CHEMILUMINESCENT FLARES**

Naval Weapons Center; and National Highway Traffic Safety Administration. S. M. Little, C. H. Morley, and D. W. Harris. July 1973. 106 pages.

### **PB-222 999**

A new type of emergency highway lighting system has been developed. These pocket-sized devices produce a bright orange light with no electrical energy and no heat evolution. The light is produced when an ampule within the device is broken to allow the mixing of two reactive solutions. One solution consists of diluted hydrogen peroxide and a catalyst; the second consists of an oxalate ester and fluoescer. Fabrication cost is less than \$0.50 US in production quantities. This document provides alternate formulations for the reactive liquids, detailed manufacturing procedures (including a complete materials and equipment list) a cost analysis, the results of environmental tests, and the results of use testing.

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**LOW COST URBAN TRANSPORTATION ALTERNATIVES: A STUDY OF WAYS TO INCREASE THE EFFECTIVENESS OF EXISTING TRANSPORTATION FACILITIES—RESULTS OF A SURVEY AND ANALYSIS OF 21 LOW-COST TECHNIQUES**

R. H. Pratt Assoc., Inc., John H. Dupree and Richard H. Pratt. January 1973. 297 pages.

**PB-223 197**

A study was made of various low-cost techniques designed to increase the effective capacity of fixed capital transportation facilities. Particular attention was given to potential volume increase or time reduction in moving people using existing facilities. The evaluation considered cost parameters, impacts on disadvantaged groups, environmental and safety factors, technical viability, and possible response from travelers. Some of the topics of importance are: Low-cost alternatives; exclusive bus lanes; reserved lanes on freeways; paved railroad rights-of-way; high-capacity buses; commuter car and bus pools; free or highly subsidized transit; feeder systems; automation of bus scheduling; improvements in urban goods movement; jitneys, taxis, and limousines; rail buses; demand-actuated service; minicars; and dial-a-bus. Considerable statistical data are included.

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**MASS TRANSIT TECHNOLOGY: A COMPREHENSIVE SURVEY OF VEHICULAR HARDWARE**

Rensselaer Polytechnic Institute. Keith S. Sibley. June 1973. 132 pages.

**PB-224 568**

One of the major phases of the transportation planning process involves the formulation of alternate transit systems for subsequent testing and evaluation. To facilitate the search for such alternatives, this document provides an inventory of contemporary mass transit hardware. The transportation systems are tabulated in an organized format and classified first according to the most appropriate functional use and second according to physical attributes. The information given includes background data, vehicle description, vehicle performance, system characteristics, land use, costs significant advantages and disadvantages, and illustrations. The systems covered exist in various stages of development, from conceptual to operational, and represent the current thinking in transit technology.

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## **PROCEEDINGS, INTERNATIONAL CONFERENCE ON HIGHWAY SIGN SYMBOLOGY**

Federal Highway Administration; and International Road Federation. June 1972. 165 pages.

### **PB-224 641**

A conference was held in June 1972 to bring together the ideas, concepts, research, and judgment of internationally known specialists who have played active roles in developing and evaluating symbol signs for effective highway use. Emphasis was on the determination of those symbols and graphic features that have been effective in communication with vehicle drivers, and the establishment of a consensus on the design, application, effectiveness, and uniformity of distinctive symbols for highway signs. The papers and addresses presented at the conference, and the formal discussions held in connection with them, are reproduced in this document. The topics covered include: Permissive versus prohibitive symbols for regulatory traffic control signs; traffic signs in Japan; suggestions for improving the unification of traffic signs and symbols; design of symbols for tourist attractions; methodology in traffic sign evaluation; motorist's understanding of the meaning of symbolic traffic signs; study of new traffic signs; some methodologies applied to symbol identification in Canada; effectiveness of symbols for lane control signals; problems relating to symbol evaluation; evaluation of road sign standards in Italy; traffic signs in Great Britain; recent research and practice on symbol sign communication in South Africa.

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## **TRANSPORTATION PLANNING IMPROVEMENT PRIORITIES**

National Research Council, Highway Research Board. 1973. 54 pages.

### **PB-224 911**

The document contains five papers on urgencies in the improvement of transportation planning. The first considers methodology development, involving use of a cost effectiveness technique, stated assumptions and objectives, and the selection and timing of investments. Next is a forecasting approach to assessing the impact of alternative highway systems with regard to long range investment planning, supplementing benefit cost analysis. The third discusses effects of varying policies and assumptions on national highway requirements, and use of computerized modeling techniques to examine these effects. The following report covers a multimodal national urban transportation policy planning model, treating each urban area as a single analysis unit in an aggregate system, and testing the effects of 12 alternatives for 63

urbanized areas. Last is an outline of the procedures used in developing unified transportation work programs in a single selected region. The interactions of agencies, reference groups, and task characteristics are observed.

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Transportation  
(continued)

### **IN-DEPTH STUDY REPORTS FROM THE WORLD SURVEY OF CURRENT RESEARCH AND DEVELOPMENT ON ROADS AND ROAD TRANSPORT**

International Road Federation; and Federal Highway Administration. June 1973. 478 pages.

#### **PB-225 301**

Twenty seven in-depth reports are presented that cover highway research work done in various parts of the world. The topics covered include: Land acquisition, including multiple use of right of way, relocation assistance, and joint development; highway design, including computer graphics, electronic plotting, environmental considerations, geometric design standards, high-speed freeways and interchanges, and fitting the highway to the landscape; pavement performance with particular reference to skidding and skid resistance; bridge design, involving fatigue, fracture, stress corrosion, and prevention of deck deterioration; construction using bituminous bases; general materials as tested by rapid and nondestructive methods; construction and maintenance equipment with reference to electronic guidance methods; highway safety, presenting research and experience with knock-down or break-away structures, and case studies on street and motorway lighting; traffic control and operations, covering the provision, location, and design of parking facilities, rural roadway edges, and geometric design criteria for freeways and interchanges; and legal studies of end-product contracts and specifications.

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### **TRANSPORTATION PLANNING: SURVEY AND SYNTHESIS**

University of Iowa, Center for Urban Transportation Studies. Henri L. Beenhakker. August 1972. 52 pages.

#### **PB-225 317**

An attempt is made in this report to establish a conceptual framework for transportation planning. This is done by relating several existing bodies of knowledge and by advancing the state of the art by focusing on the establishment of optimal implementation times of transportation facilities. Suggestions are presented for the qualification of impacts of transportation facilities such as noise, pollution, and safety. An approach that calls for employment of casuistic models in combination with subjective models is recom-



**Transportation**  
(continued)

mended for transportation investments requiring large capital outlays. A discussion of existing dynamic programming models is included, and new approaches to establishing optimal implementation times are presented. Consideration is also given to models for optimizing stage construction.

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**URBAN MASS TRANSPORTATION ABSTRACTS:  
VOL. 2**

Urban Mass Transportation Administration. September 1973.  
243 pages.

**PB-225 368**

The volume contains 194 abstracts of reports in the field of urban mass transportation that are available from the National Technical Information Service. The reports cover research, development, and demonstration, technical studies, and university research and training projects. Each abstract contains complete bibliographic data, keyword identifiers, and the NTIS accession number and price. Abstracts from Vol. 1 are also cross referenced. The abstracts cover a broad spectrum of urban mass transportation data of interest to engineers, planners, students, transit managers and operators, public administrators, and personnel in related fields. Further volumes of such abstracts will be forthcoming. (Vol. 1 in this series is available as PB-213 212.)

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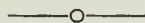
# **URBAN & REGIONAL PLANNING**

## **MATHEMATICAL MODELS FOR REGIONAL PLANNING**

University of Texas, Center for Economic Development. David Kendrick. December 1970. 68 pages.

**COM-73-11956**

Mathematical models for regional economic planning are discussed. Particular attention is given to relationships between the economic assumptions made, the methods of computation used to solve the models, and the degree of disaggregation that may be achieved with reasonable computational expense. Both simulation and optimizing models are considered. The paper begins with a review of the characteristics of regional models as compared with economy-wide models for single period and multiperiod coverage. Economy-wide models are viewed as rather complex and expensive to solve. Two approaches are noted. The first is to add a special dimension to economy-wide models, thereby converting them to regional ones; such a procedure cannot help in determining exactly where to locate the new production facilities, but it does indicate preferred regions. The second is to use multiple regions or locations and a single industry; there is a disadvantage in that sectoral interdependencies are not accounted for. Four aspects are considered in detail: Interregional commodity flow; the mobility of production factors such as capital, labor, land, and water; transportation and its costs; and aggregation procedures to reduce model data requirements.



## **MULTISECTORAL MODELS OF REGIONAL DEMOGRAPHIC AND ECONOMIC GROWTH**

University of California (Berkeley), Center for Planning and Development Research. Andrei Rogers and Susan McDougall Choy. February 1966. 179 pages.

**COM-73-11973**

Study of a developing geographic region has usually considered demographic growth and economic development or growth without reference to each other. The report holds that in the real world interdependence between the two is great and of much importance. Thus if valid models of regional growth are to be constructed the

interrelations between the economic models and the demographic models must be taken into account, since a continuous process of adjustment is going on between them. It is desirable for effective planning to have consistent forecasts of both demographic and economic activity. Establishing linkage between the two systems allows better use of available information. An examination is first made of the cohort-survival model as the basic demographic model. Next, consideration is given to the input-output model as the basic economic model, involving flows of goods and services. Linking is provided by a multisectoral growth model, with attention to balanced growth. Three multisectoral macroeconomic models are reviewed as based on input-output models.

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### PLANT LOCATION DECISION PROCESSES

Memphis State University, Division of Urban and Regional Studies. Robert Dean. 1972. 32 pages.

#### COM-74-10010

Much has been written in recent years on the subject of industrial plant location, with the theoretical studies being generally deductive—normative and the empirical ones usually lacking integration between theory and practice. Little attention has been devoted to the decision making processes involved. The report is directed toward a better understanding of such decision making. It focuses on the sources and types of information that enter into choosing a new plant site, the characteristics of participants in the decision, consideration of alternatives, and the institutional or individual constraints affecting a decision. The study is limited to plants in manufacturing industries. Officials in some 150 firms were interviewed, at various levels of responsibility. A summary of the survey findings is presented, and some conclusions are drawn.

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### HOUSING: SYMBOL AND SHELTER

University of California (Los Angeles). Leland S. Burns, Robert G. Healy, et al. February 1970. 185 pages.

#### PB-219 575

There is no disagreement that adequate housing is not simply desirable but a necessary component of life, and there is general agreement that proper shelter is a part of economic development in any region. At the same time there is lack of agreement about the character or magnitude of that role, particularly where scarce development capital allocation to housing is concerned. The report attempts to articulate a rationale for investment in housing in the context of development planning for underdeveloped areas. Six development sites are discussed: The Pine Ridge Indian Reservation in the United States, and the communities of Ham-



back in Korea, Monterrey in Mexico, Zacapu in Mexico, Guayana in Venezuela, and Limura in Kenya. Studies are made of income, housing projects, environmental factors, worker productivity, community relations and facilities, and the relation of improved housing to all of these. Attention is given to economic theory, construction factors, and health relationships.

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Urban & Regional  
Planning  
(continued)

### **CITIZEN COMPETENCE IN POST-INDUSTRIAL SOCIETY: AN EVALUATION OF THE PUERTO RICO CITIZEN'S FEEDBACK PROGRAM**

Ohio State University. Philip M. Burgess, C. Richard Hofstetter, and Louis D. Higgs. 1972. 33 pages.

**PB-225 356**

The Puerto Rico Information and Decision Environment project, identified by the acronym PRIDE, is a prototype planning and decision indicator system intended to serve agencies and the public with broad urban management guidelines. The citizen feedback system is an important new development in citizen-to-government communication, providing better interrelation between public programs and services and the individual citizen, and increasing the responsiveness of government to the problems of the citizenry. There are two broad categories of feedback; Service, which includes inquiries, requests, and complaints; and Involvement which takes in opinions, suggestions, and volunteering. A public service handbook and easily accessible personnel called citizen aides are key components for handling letters, phone calls, and personal visits. The report follows the procedures involved, and applies them to an islandwide system. Results are given of a survey of opinions on the most important Puerto Rican problems and what is being done about them.

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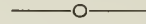
### **SYSTEMS ANALYSIS IN LAND-USE PLANNING: A CONCEPTUAL DEVELOPMENT**

Pacific Southwest Forest and Range Experiment Station. Ronald A. Oliveira. 1973. 12 pages.

**PB-225 482**

With increase in population pressure and other factors affecting national goals, land use decisions have become increasingly complex and difficult. Choices must be made between conflicting uses of resources. A planning model in which social, economic, and environmental constraints are specified in mathematical form can aid in the decision making. The report describes the general structure of a land use decision model approached through sys-

tems analysis. The procedures emphasize quantification of interrelationships between uses and the specification of preferences and goals. An illustration is given of how the model might be applied to a Forest Service ranger district of a national forest.

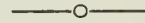


**LAND USE AND THE ENVIRONMENT:  
AN ANTHOLOGY OF READINGS**

American Society of Planning Officials. May 1973. 208 pages.

**PB-225 521**

Of all the factors that determine the quality of modern day environment, the most fundamental is considered to be the use that is made of the land. Ecologically irresponsible practices and ineffective control lead to environmental degradation, polluted air and water, and varied other problems. The document presents 24 discussions that emphasize the vital link between the areas of environmental quality and land use. The readings present concepts of land use, the relationships between land and environment, the importance of national and state policies, incentives for control, and potential conflicts that may appear as the result of alternative land uses. Among the topics covered are nature in the metropolis, urban population expansion, criteria for land-use planning, guidance systems, national policies, legislation, harmonizing development with conservation, public-facility planning, outdoor noise, waste-land improvement with waste water, and examples of operating programs.



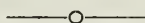
# **WASTE PROCESSING & MATERIALS RECOVERY**

## **RECOVERY OF CHEMICALS FROM DESALTING PLANT BRINES**

Environmental Quality Engineering, Inc. Richard L. Clark. March 1973. 301 pages.

### **PB-220 618**

In the process of recovering fresh water from sea water, a desalting plant also produces a brine that is concentrated with respect to its salt content. The practice has been to discharge this brine back to the sea. From the fact that chemicals are extracted from sea water commercially, it is reasonable to expect that processing desalting plant brine could be profitable. This report provides a preliminary analysis of potentially suitable chemical recovery processes and a most detailed examination of selected processes. An effort was made to identify components of brine that appear both salable and profitable. Magnesium and its salts were selected for detailed examination. Processes to recover magnesium products were selected that include a number of variations with respect to the by-products and unit operations. The selected processes are presented as process flow diagrams with accompanying material balance data. Major equipment lists are presented, and these are used to obtain capital costs of the chemical plants. Production costs are estimated for each of the overall processes. Plant economics are then compared on their average percent return-on-investment values. Effects of plant size and cost parameter variation are also investigated. The minimum economical chemical recovery plant size and the incremental costs of desalting plant brine disposal are also presented.



## **PACKAGE SORPTION DEVICE SYSTEM STUDY**

MSA Research Corp. A. J. Juhola, R. H. Hiltz, et al. April 1973. 516 pages.

### **PB-221 138**

A "package sorption device" may be considered to be an air pollution control device operating on the sorption principle and having the following characteristics: small size; simple, easy installation; availability in essentially off-the-shelf form; relatively low maintenance; and relative low cost. This document provides



a handbook on packaged sorption device technology, an assessment of the types of emissions to which the technology may be applicable, and recommendations for future research and development. The first sections of the document are oriented toward the needs of management personnel responsible for the planning of future action in pollution control. It gives consideration to small pollutant sources and the characteristics of their emissions, the adverse environmental effects of air pollutants, and recommendations for research and development work. The later sections, which comprise the Package Sorption Device Handbook are directed toward design engineers, fabricators, and control device users. It also contains information that may be of use to scientists interested in adsorption. The topics covered include: Sorbent types and sorbent theories; theories and types of catalysts; package sorption systems (basic functions, air purification systems, solvent recovery systems, polar adsorbent systems, impregnated adsorbent systems, catalyst impregnated carbon systems, economic analysis); catalytic incineration system; air pollutant detection. Also included is a bibliography pertinent to air pollution and its control by sorption and incineration.

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### **BIOLOGICAL CONVERSION OF ANIMAL WASTES TO NUTRIENTS**

Colorado State University, Department of Avian Science. Byron F. Miller. June 1973. 82 pages.

#### **PB-221 171**

Ideally, poultry wastes should be used economically, in a fashion that avoids the spread of disease and pollution of air, soil and water. As one step toward the attainment of this ideal, a study was undertaken to determine how living organisms may be used to catabolize poultry manure. To this end, fresh manure was inoculated with house fly (*Musca domestica*) eggs and incubated under various conditions. The resultant fly larvae, under proper conditions, reduced the fresh manure to less odorous granular material within a few hours. This material, combined with dried fly pupae, was used in feeding trials with chickens. The results indicate that the combination has potential as a protein supplement in chick starter and broiler diets. The amino acid composition indicates that the protein quality is similar to that of meat and bone meal or fish meal, and superior to soybean oil meal.

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### **ACID HYDROLYSIS OF CELLULOSE IN REFUSE TO SUGAR AND ITS FERMENTATION TO ALCOHOL**

Dartmouth College, Thayer School of Engineering. A. O. Converse, H. E. Grethlein, S. Karandikar, and S. Kuhrtz. June 1973. 113 pages.

#### **PB-221 239**

In 1966 A. Porteous proposed a new method for waste disposal that consisted of hydrolyzing the cellulosic content of the refuse to sugar. This sugar in turn could be used to produce ethanol by fermentation. This document presents an evaluation of the technical and economic feasibility of the method. The kinetics of the hydrolysis of paper in a nonisothermal batch reactor, and the hydrolysis of refuse in a continuous plug-flow reactor are examined. The results provide data for an economic analysis of the acid hydrolysis of refuse. The fermentation of the product sugar, together with the treatment of the process refuse, is discussed in detail. It is shown that, under the proper circumstances, it can be economically attractive to convert the cellulose in refuse to sugar or ethanol.

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### **PHOSPHORUS REMOVAL: A BIBLIOGRAPHY. VOL. 1**

Water Resources Scientific Information Center. May 1973. 280 pages.

**PB-221 477**

### **PHOSPHORUS REMOVAL: A BIBLIOGRAPHY. VOL. 2**

Water Resources Scientific Information Center. May 1973. 470 pages.

**PB-221 478**

This bibliography contains abstracts of articles, reports, and monographs concerning the removal of phosphorus and its compounds from wastewaters. Vol. 1 contains abstracts of materials originally published through 1969; and Vol. 2 covers the years 1970 through 1972. Subject and author indexes are included.

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### **WOOD WASTE REUSE IN CONTROLLED RELEASE PESTICIDES**

University of Washington, Institute of Forest Products. G. G. Allan, C. S. Chopra, et al. July 1973. 96 pages.

**PB-222 051**

Despite the desirability of controlling agricultural pests and the intrinsic effectiveness of the pesticides available, the sophistication of the methods of application leave much to be desired. Consequently, the efficiency of a pesticide in terms of pesticide necessary to pesticide applied is usually low. Furthermore, pesticides have rather short useful lives because they may be degraded by bacteria or leached into the soil. If, in contrast, the pesticide were not simply broadcast over the treatment area but chemically combined with a polymeric solid by displacement of a replaceable hydrogen atom, then its useful life should be prolonged. As the solid-pesticide combination lies on and in the soil, it would gradually decompose, continuously releasing the active pesticide over

a long period of time. This document describes the preparation and testing of such a combination. It was found possible to combine herbicides and insecticides with wood wastes. Theories that permit the prediction of the period of effectiveness of wood-pesticide combinations were developed and validated. The effectiveness of such products was found to be significantly greater than the corresponding quantity of uncombined pesticide. By way of example, field tests in Costa Rica demonstrated the practicability of using a wood-insecticide to control the cedar and mahogany shootborer using one application per year.

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## **WATER POLLUTION POTENTIAL OF MANUFACTURED PRODUCTS. CATALOG SECTION 1—SUMMARY**

Environmental Protection Agency, Office of Research and Monitoring. J. B. Berkowitz, G. R. Schimke, and V. R. Valeri. April 1973. 113 pages.

**PB-222 248**

## **WATER POLLUTION POTENTIAL OF MANUFACTURED PRODUCTS. CATALOG SECTION 2—PRODUCT LISTING**

Environmental Protection Agency, Office of Research and Monitoring. J. B. Berkowitz, G. R. Schimke, and V. R. Valeri. April 1973. 880 pages.

**PB-222 249**

## **WATER POLLUTION POTENTIAL OF MANUFACTURED PRODUCTS. CATALOG SECTION 3—CHEMICAL INGREDIENT LISTING**

Environmental Protection Agency, Office of Research and Monitoring. J. B. Berkowitz, G. R. Schimke, and V. R. Valeri. April 1973. 382 pages.

**PB-222 250**

This series of documents provides a comprehensive listing of data on the pollution potential of a wide variety of manufactured products. These data will be useful in pollution control activities. Section 1 contains summary data, by general product category, on pollution potential factors. These include: Persistence, toxicity, oxygen demand, solids, color, odor, eutrophication, oils and tars, and water hardness. Section 2 contains similar data on specific products. In addition, the typical chemical composition of each product is given. Section 3 contains a listing of chemical compounds and the kinds of products in which they occur. It also contains toxicity data and oxygen demand listed by chemical compound, and a bibliography.

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## **PHOTOSYNTHETIC RECLAMATION OF AGRICULTURAL SOLID AND LIQUID WASTES**

University of California (Berkeley), Sanitary Engineering Research Laboratory. C. G. Golueke, W. J. Oswald, et al. August 1973. 94 pages.

### **PB-222 454**

Work has been undertaken to develop a system with which agricultural waste products can be converted to useful materials. One approach, described in this report, involves an anaerobic fermentation and algae growth system for solid and liquid wastes. A pilot-plant system was developed in which poultry manure is converted to a culture medium for algae that, in turn, is dried for use as an animal feedstuff. A similar system uses potato processing waste as an algae culture medium. A conceptual design of an algae regenerative system for villages or single-family farms is included in the report.

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Waste Processing  
& Materials  
Recovery  
(continued)

## **GUIDE TO THE PREPARATION OF OPERATIONAL PLANS FOR SEWAGE TREATMENT FACILITIES**

Synectics Corp. Earl L. Seiler and James W. Altman. July 1973. 221 pages.

### **PB-223 346**

A proceduralized methodology is provided to guide the initial and ongoing planning necessary for extracting the maximum potential from waste water treatment plants. The activities outlined in the Guide emphasize the development of conceptual and applied tools for direct use by plant personnel in optimizing the cost effectiveness of their plant, complementing the design engineering of the physical plant. Five major steps in the preparation of operational plans are discussed in detail. These are: Definition and management of the operational planning program; delineation of plant performance characteristics; definition of task and job requirements; preparation of job aids; and assessment of operational planning information. Heavy emphasis is placed on general methods and principles that can be applied to a wide variety of specific treatment plant designs and situations. Attention is also given to planning materials considered to be essential to plant functions of management, operations, and maintenance. These include job descriptions, plant manuals, checklists, reference materials, task schedules, decision tables, and operating records.

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## SELECTED ABSTRACTS FOR INSTRUMENTATION AND AUTOMATION OF WASTEWATER FACILITIES

Raytheon Co., Environmental Systems Center. Allen E. Molvar  
and Joseph F. Roesler. 1973. 313 pages.

### PB-225 520

This collection of abstracts summarizes about 600 technical articles relating to instrumentation and automatic control in wastewater treatment plants. The materials are classified according to four categories: Instruments, control experiences and strategies, costs, and support material. A few of the topics concerned are biochemical oxygen demand, heavy metals, nitrogen forms, pH, phosphates, suspended solids, toxicants, water quality, aeration, ammonia removal, activated sludge, computer control, electro-dialysis, filtration, neutralization, reverse osmosis, screening and microstraining, wet-weather facilities, equipment costs, combined storm sewers, and sampling. The period covered by this compilation is 1967-73.

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# **WATER SUPPLIES & HYDROLOGY**

## **METHODS OF MEASURING SOIL MOISTURE**

McMaster University. Richard G. Wilson. 1971. 28 pages.

### **COM-73-11266**

Three hydrological aspects of the physical condition of water in soil that require measurement are: (1) The amount of water; (2) the energy with which the water is held in the soil; and (3) the movement of the water. This document provides a review of the techniques and the potential errors and accuracies involved in the measurement of these three aspects of soil moisture. It initially deals with the main methods of measuring soil moisture on a volumetric basis. Consideration is then given to the basic theory and the techniques used for determining the subsurface flow water, because it is increasingly apparent that a knowledge of water movement within the soil body is critical to an understanding of soil moisture interaction with the plant and atmospheric environment. Also included are notes on new experimental approaches for directly monitoring soil water fluxes and for determining soil moisture patterns using remote sensing techniques.

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## **CRITICAL REVIEW OF CURRENTLY AVAILABLE WATER QUALITY MODELS**

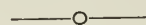
Hydrocomp, Inc. Pio S. Lombardo. July 1973. 96 pages.

### **PB-222 265**

As industrialization, urbanization, and agricultural water use have expanded, an increase has occurred in water quality degradation, directly attributable to man's activities. Some measure of quality therefore is being increasingly required. To describe water quality simply as good or bad is insufficient, since water unacceptable for one use may be valuable in another. The report discusses water quality models as dependent upon the particular system and the problems to be analyzed. It is initially noted that there is no model that has yet proven its utility for water quality management. Furthermore, not only is the quantity of data inadequate but what data have been collected do not account for all the sources and sinks involved. The Hydrocomp model of Lombardo and Franz is cited for suitability following a review of six currently available ones. The following points are observed: Model-



ing provides the ability to determine management scheme effects on the aquatic environment. Important problems are choosing length of the time period for simulation and evaluating the generated information.

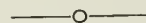


### **IMPROVEMENTS IN MOVING SPRINKLER IRRIGATION SYSTEMS FOR CONSERVATION OF WATER**

Colorado State University, Department of Agricultural Engineering. Donald L. Miles. June 1973. 167 pages.

#### **PB-222 267**

The irrigation of slopes and hilly land requires uniformity of water application and uniformity of soil adsorption or infiltration. The center pivot sprinkler has proven satisfactory for water application. In this system one end of a sprinkler lateral rotates about its pivot point irrigating a circular area with water supplied under pressure at the pivot point. The lateral consists of sprinkler heads mounted on a pipe supported by a traveling tower propelled by one of several ways. Such a self-propelled sprinkler system operating 8 to 13 feet above the ground can irrigate sand-hills previously considered uneconomical to utilize. However, if the soil infiltration cannot match the water application, runoff from slopes and high places to nearby low areas occurs, causing waste of water and yield reduction. The report covers an investigation to determine the effect of time-varying water application on infiltration rates under moving sprinkler systems, to develop mathematical models of watering systems to obtain improved performance, to find methods of increasing soil infiltration rates, and to study other potential modifications of the moving system to increase irrigation uniformity and to conserve water. Data from an extensive literature review are used, including soil properties, infiltration equations, and analytical solutions. Field tests and laboratory experiments are reported. The results are discussed, and some conclusions and recommendations are presented.



### **INSTITUTIONAL REQUIREMENTS FOR OPTIMAL WATER QUALITY MANAGEMENT IN ARID URBAN AREAS**

Colorado State University, Environmental Resources Center. Wynn R. Walker, Gaylord V. Skogerboe, et al. June 1973. 45 pages.

#### **PB-222 495**

Regional urbanization is a worldwide phenomenon, and one of the many problems that it engenders is administration of water resources. The problem is particularly acute in arid regions. This document considers the feasibility of alternative water manage-

ment strategies for arid urbanizing areas that could be implemented to alleviate the problems of water shortage and deterioration of water quality. Particular attention is given to aspects of water resource administration: (1) Coordination of the supply, distribution, and treatment of water in the metropolitan setting; and (2) Regional integration of agricultural and urban water pollution control. A modeling procedure is presented that describes the interrelationships among various institutional factors in order to delineate the requirements for implementing optimal policies. The results of applications of the model to several actual cases are given. Some of the more important institutional factors affecting water management are discussed. These include the reallocation of water resources, combined management of water resources, public attitudes, and water quality standards.

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### **SELECTED IRRIGATION RETURN FLOW QUALITY ABSTRACTS 1970-1971**

Colorado State University, Agricultural Engineering Department.  
Gaylord V. Skogerboe, Wynn R. Walker, et al. June 1973. 285 pages.

#### **PB-222 796**

This compilation contains about 450 abstracts of documents, on the subject of irrigation water return flow quality, which were published during the years 1970-71. The subject matter covered pertains to water quality problems resulting from irrigated agriculture, potential technological solutions for controlling return flows, recent research pertinent to return flow investigations, and institutional constraints in irrigation return flow quality control. Subject and author indexes are included.

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### **A METHODOLOGY FOR ASSESSMENT OF WATER RESOURCES DEVELOPMENT: A COMPETITIVE EVALUATION MODEL FOR WATER RESOURCES DEVELOPMENT PLANNING**

University of Oklahoma, Bureau of Water Resources Research.  
George W. Reid, and Silas S. Y. Law. July 1973.

#### **PB-224 825**

Theoretically, for effective allocation of water resources, evaluation methodology for development planning is essential and important. More adequate development planning is needed in developing countries, and evaluation procedures for development planning in more advanced countries have reached a point where basic revision is needed. An evaluation methodology, designated as the competitive evaluation model, is presented in this report. The method uses terminology usually employed exclusively in

the theory of games. The model is mainly a collection of sets of games that are used to obtain comparison information between water resource developments. These comparisons can be used to formulate recommendations for the decision-maker.

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## **DYNAMIC WATER QUALITY FORECASTING AND MANAGEMENT**

Manhattan College. Donald J. O'Connor, Robert V. Thomann, and Dominic Di Toro. August 1973. 201 pages.

### **PB-225 048**

Two modeling frameworks are described in this document, which should be useful for guiding the preliminary planning of remedial actions to improve water quality in an estuarine environment. The first model is directed toward an analysis of the impact of carbonaceous and nitrogenous components and waste water on the dissolved oxygen resources of a natural water system. The second modelling framework concentrates on the interactions between the discharge of nutrient (nitrogen and phosphorus) and the biomass of the plankton populations that result, as well as incorporating the overall impact on dissolved oxygen. The models are formulated in terms of coupled differential equations that incorporate both the effect of tidal motion and turbulence, and the kinetics that describe the biological and chemical transformations that can occur.

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## **PLANNING AND DESIGN FOR URBAN RUNOFF AND SEDIMENT MANAGEMENT**

University of Kentucky, College of Engineering. C. T. Haan, and B. J. Barfield. July 1973. 34 pages.

### **PB-225 274**

Among the problems introduced by regional urbanization are the serious effects on natural water flow. Conversion of agricultural, forest, or idle land to subdivisions, shopping centers, office complexes, industrial areas, or other urban features leads to increased runoff problems, erosion, and sedimentation. Sediment alone can clog storm sewers, fill lakes and ponds, choke streams, kill aquatic life, and create dust. The proceedings are presented of a two-day conference aimed at bringing the availability of techniques to reduce these problems to the attention of planners, developers, engineers, and the public. Community action and preplanning development are particularly stressed, since piecemeal development of small areas here and there makes effective runoff and sediment control extremely difficult. Some of the topics covered include impact or flexible zoning, project planning



for runoff-sediment management, runoff prediction, sedimentation processes, storm draining systems design, urban storm runoff controls, and urban sediment control.

Water Supplies &  
Hydrology  
(continued)

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## **BIBLIOGRAPHY ON OPTIMIZATION OF IRRIGATION SYSTEMS**

University of Illinois, Water Resources Center. Dale D. Meredith. September 1973. 128 pages.

### **PB-225 478**

One of the objectives of research in water resources is to formulate simple yet realistic models that can be used in the planning process. As one aspect of this problem, this document provides a bibliography on irrigation models and optimization methods. The first section contains references on plant response to its physical environment. It is primarily concerned with response to applied water, but also contains references to related conditions such as the amount of fertilizer applied and soil temperature. The second section is comprised of references on optimization methods that have been applied to irrigation studies. The bibliography covers most items of basic significance to the subject and thus should provide a useful source in information to anyone interested in irrigation.

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## **ARID URBAN WATER MANAGEMENT: SOME ECONOMIC, INSTITUTIONAL AND PHYSICAL ASPECTS**

University of Nevada, Center for Water Resources Research. G. F. Cochran, and W. C. Wilson. November 1971. 71 pages.

### **PB-225 511**

The report deals with obtaining, by means of systems analysis, an efficient method of managing and developing a conjunctive water supply system for an urbanized arid area. Optimal methodology requires consideration of economic, legal, institutional, and physical factors. The study area is a valley in southern Nevada where a ground and surface water supply system has been established. A report is made on possible future population growth and water requirements for the region. Water use projects are described based on types and areas of use as related to land use and area economics. Pricing schemes are examined for inequities, and water related institutions are studied for ability to control the water resources. An organization is considered that might enhance control and optimize use of the total resources. Models of the physical components of a conjunctive water resources system for the area are drawn up and discussed with relation to control. The discussion should be of interest to other arid urban areas.



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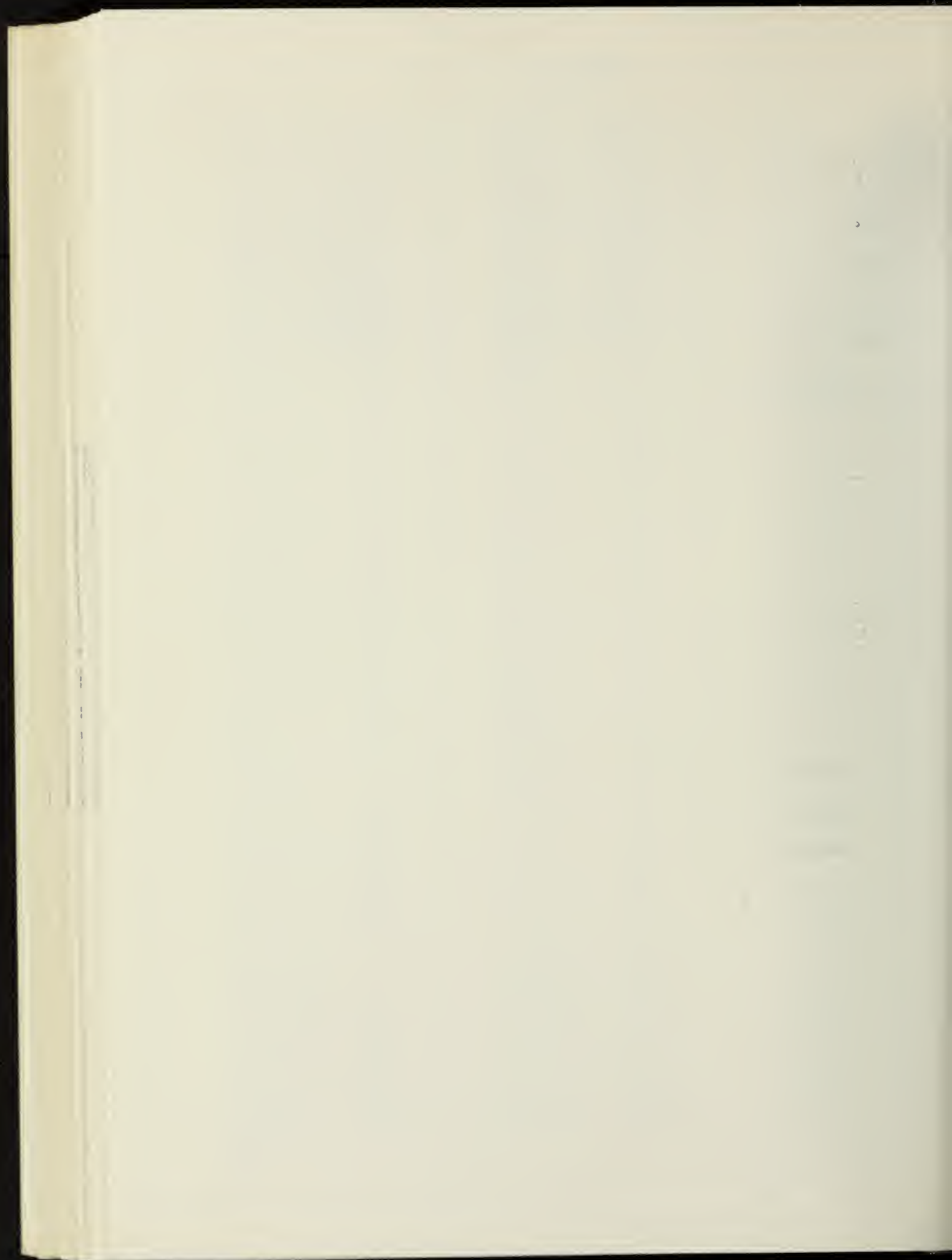
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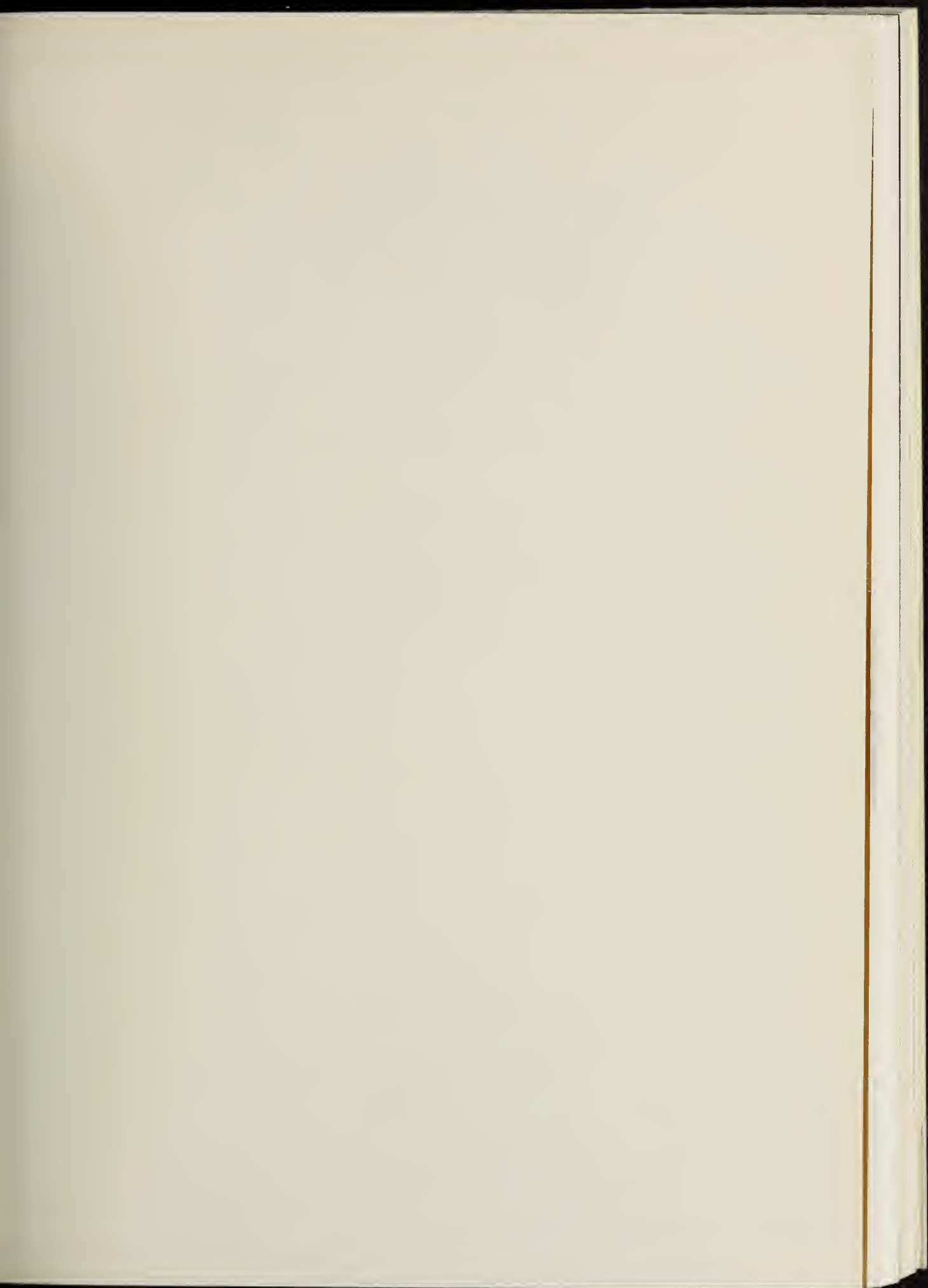
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WASHINGTON, D. C.

# Application of Modern Technologies to International Development

AGENCY FOR INTERNATIONAL  
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*Application of Modern Technologies to International Development* (AMTID) — Application des technologies modernes au développement international) est publié au titre d'une action commune poursuivie conjointement par l'Agence U.S. du développement économique (US AID) et le Service national d'information technique (NTIS). Le but d'AMTID est de signaler certaines publications techniques américaines à l'attention des personnes et organisations intéressées des pays en voie de développement, afin de faciliter le transfert de technologies vers ces mêmes pays.

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Os relatórios descritos neste catálogo representam o resultado de pesquisas financiadas pelo Governo dos Estados Unidos. Os assuntos que eles abrangem foram ampliados a fim de dar maior realce às áreas de especial importância para os países em desenvolvimento.

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# INTRODUCCION

*La Aplicación de Tecnologías Modernas al Desarrollo Internacional* (AMTID) Se publica como parte de un programa conjunto a cargo de la Agencia Estadounidense de Desarrollo Internacional (US AID) y el Servicio Nacional de Información Técnica (NTIS). El principal fin de AMTID es llamar la atención de las personas y organizaciones interesadas en los países en desarrollo, a ciertas publicaciones técnicas de los Estados Unidos, facilitando así la transferencia de tecnología a dichos países.

Los informes descritos en este catálogo representan los resultados de investigación sufragada por fondos del gobierno de los Estados Unidos. Se han ampliado los temas para dar cabida a mayor énfasis en sectores de especial interés para los países en desarrollo.

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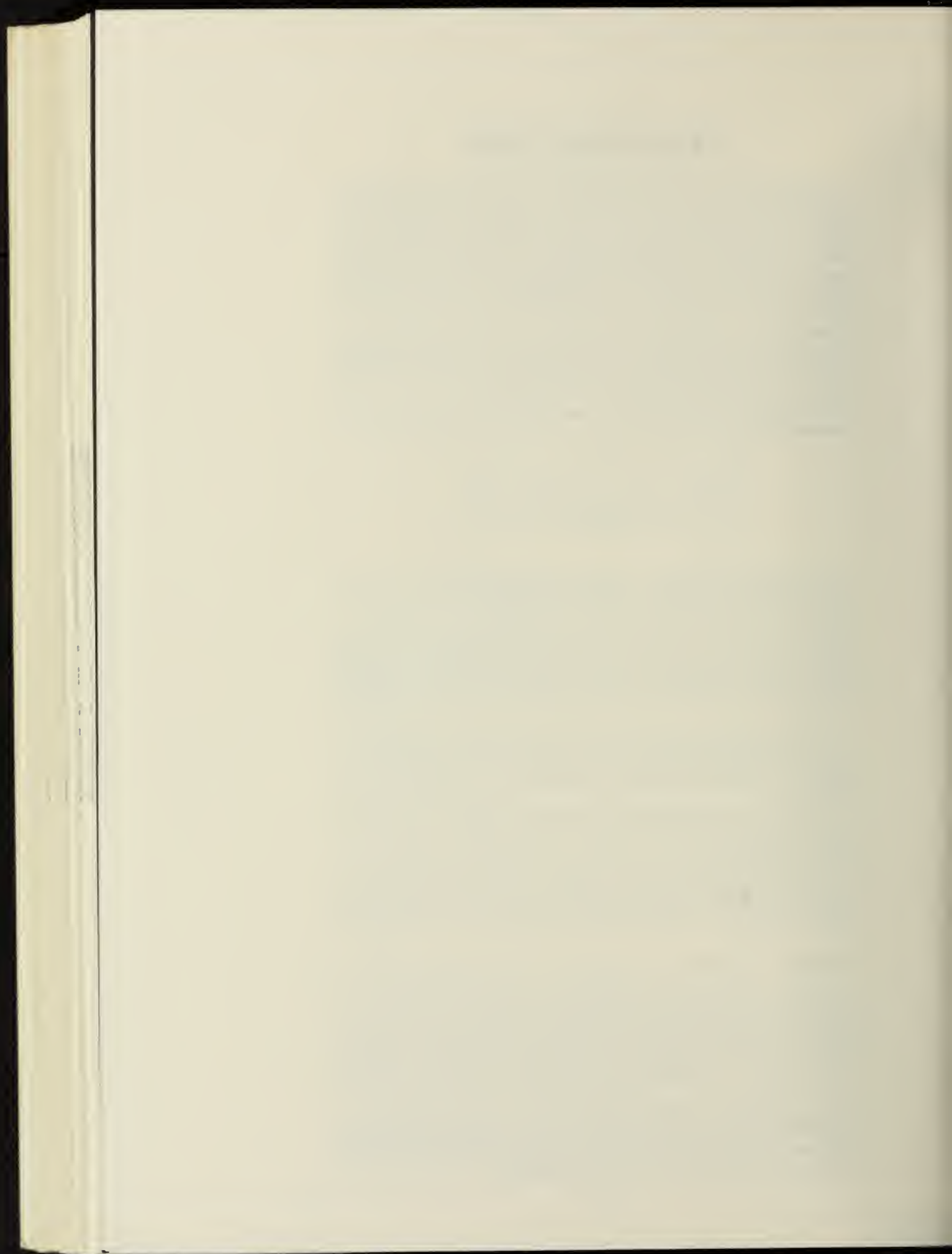
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## AGRICULTURAL ECONOMICS

### Report for Analysis for Accelerating Agricultural Productivity in Less Developed Countries

National Marketing Institute. Simon Williams. 1970. 116 pages.

16 629

Report begins by stating that accelerating economic development among rural people is good, although the rural people may not fully understand what's going on. With evidence that demonstrates achievements, that otherwise would remain vague or only conceptual, understanding will come through. Thus a method for isolating agricultural and agribusiness investments in the rural areas of developing countries as one element in a general approach to world hunger and rural depression is seen as requiring both technical assistance and the management of human beings, with the best protection against overmanagement and arbitrary control reposing in the hands of the rural people themselves. The methodology requires more expertise than any one individual can provide, so that every project search will lead into financial, social, cultural, and political fields. Also, observation is made that only a few successful commercial projects will pay off the costs of any rejects. A project is defined as an agriculturally based private enterprise, self contained legally and operationally, conducted for profit with the rewards ultimately passing to the farmers and ranchers whose lands and labor have been devoted to the effort. Projects are expected to concentrate initially on applying existing but ineffectively used knowledge and technology. Particular reference is made to the rural poor.

### Linkages of the New Foodgrain Technologies

University, Department of Agricultural Economics. John W. Mellor and Uma J. Lele. May 1972. 32 pages.

18 127

Report discusses a complexity of relationships in low-income economies between foodgrain production, foodgrain varieties, upper income groups, the laboring masses, employment, and foodgrain consumption. Some of the relationships are as follows: (a) The laboring masses spend a larger proportion of their income on foodgrain than on any other commodity, whereas the upper income classes

tend toward a marginal consumption of foodgrain; (b) increase in the employment and income of the poor would require an expanded supply of foodgrain, which by increased consumption would add income to the upper income groups (thus a unity exists between the desire of the rural rich for expanded foodgrain markets and the desire of the rural poor for greater employment); (c) successful introduction of new, high yield, foodgrain varieties adds substantial net income to the upper income people by raising the national income, so that their marginal consumption of these grains leads to the development of sectors other than the grain sector, and supports employment in other sectors. The report pursues some of the considerations involved in these relationships, such as differential distribution of benefits from new technologies on marketing, draws up a general equilibrium model for a dualistic economy, and gives some implications for further study.

### Land Reform in Latin America—Issues and Cases

University of Wisconsin, Land Tenure Center. Peter Dorner (Ed). 1971. 296 pages.

PB-219 300

In rural areas land ownership or tenure security may provide the farmer his only means of participating in the national political or economic life. Most Latin American populations are 40% or more in agriculture with the proportion reaching, in some cases, 60% or 70%. Difficulties arise from high concentration of land ownership, increasing rural to urban migration, unrealized production capacity, unfulfilled potential for rural employment, highly skewed income distributions, and a gulf between the farm masses and the upper classes. Needed improvement in agricultural output, employment, and worker productivity is unlikely to occur without reorganization of the land system. The report discusses the highly controversial political question of land reform. An argument is made for economic development by relieving the dichotomy between large and small farm operations. New experiences with cooperative and collection systems are observed in Cuba, Chile, Peru, and elsewhere, aimed at dispelling any assumption that land reform is inconsistent with economic growth. Interrelations are described between land reform, employment, and rural-urban migration. The importance of better cadastral and titling systems is underlined. Some private efforts at reform are noted. Based on the analysis, some policy implications for national governments and international efforts are summarized.

## **Customary Land Tenure and the Development of African Agriculture**

University of Wisconsin, Land Tenure Center. Kenneth H. Parsons. June 1971. 83 pages.

**PB-219 322**

Tenure policy, traditional or modern, defines the access to opportunities on a nation's land. It designates the conditions of land use, ownership, and returns on investment, thereby affecting incentives for optimization or improvement. Some possibilities are discussed for stimulating agricultural development in tropical Africa, noting ways in which tenure systems relate to farming systems, with attention to the performance of participants in the agricultural economy. A basic issue is land ownership. An owner cultivator receives income from labor, management, or investment; a tenant has income from labor and management; the sharecropper gets only labor income. Participants in collective farming may share in all three kinds of income. Thus the incentives and rewards are different according to roles. The discussion is arranged under the headings of customary tenure in subsistence agriculture and the possibilities for land reform, innovative shifts in commodity production and family land management, pressures for change in both attitudes and methodology, and the relation of tenure policies to modernization, mechanization, and land alienation.

## **Rural Problem-Solving Policies in Venezuela, with Special Reference to the Agrarian Issue**

University of Wisconsin, Land Tenure Center. Jorge F. Schuster. May 1972. 118 pages.

**PB-219 332**

The study examines the evolution of problem solving agricultural institutions in Venezuela, considering agriculture as a problem area for public policy. Ideological and subjective elements have often prevented the problem from being attacked with optimality or sometimes economic rationality. Venezuelan policies in problem areas have remained similar through time, even though the decision makers have changed rather rapidly. Experience in agricultural policy in Venezuela suggests that bringing about change in an economic sector displaying traditionism and technical backwardness is related to the diffusion of political power within the decision-making process. The pressure exerted by political parties and interest groups has played a vital part in agricultural economic policy, overcoming governmental inertia. A basic feature of the rural problem solving system that might be relevant to other developing countries is a dual approach toward agricultural backwardness. Applying different policies to the commercial and subsistence traditional sectors of agriculture has made rapid and sustained growth of farm output possible while maintaining

considerable security of expectations within both sectors. Thus stagnation in production was avoided while simultaneously defending against the most flagrant of injustices. The result has been a slow and gradual improvement of living conditions of the agrarian masses. Benefits from the 1960 agrarian reform program are described.

## **Rural Development in Africa: A Bibliography Part 1: General, Central, East.**

University of Wisconsin, Land Tenure Center. July 1971. 87 pages.

**PB-219 335**

The bibliography begins with materials on African culture, economic affairs, technical assistance, land resources, law, money and banking, politics and government population, social affairs, trade and commerce, transport, and communications. Next are references for central Africa, including Cameroon, Central African Republic, Chad, the Congos, and Gabon. East African countries refer to Afar, Issa, Burundi, Ethiopia, Madagascar Republic, Malawi, Mauritius, Rwanda, Senegal, Somali Republic, Tanzania, Uganda, and Zambia. The materials on individual countries are then listed as for Africa in general.

## **Technological Change and Income Distribution in Latin American Agriculture**

University of Wisconsin, Land Tenure Center. V. C. Thiesenhusen. August 1971. 34 pages.

**PB-219 336**

A neglected problem in the agricultural development of Latin America is the interrelation between technological change and inequitable income distribution. As new technology such as higher yielding grains, fertilizers, and mechanized equipment is adopted at an increasing rate, as is probable during the near future, more jobs for the poor and increased income flows to the privileged are likely. Thus the problem may become critical, even unacceptably so, unless government redress increasing imbalances. The report is addressed to that issue. A review is made of the effects of



cultural inputs in parts of Latin America already  
ved. Wheat in Mexico, corn in Chile, and machinery  
Colombia are three examples. Some possibilities for  
ting further skewness in income are noted, such as  
ian reform to slow farm-to-city migration, rural  
nal industrialization, and manufacture of simple  
mer goods in preference to durables while countries  
por. The discussion includes bank credit and small-  
operations.

### **Economic Aspects of Hand Tractor Ownership Operation**

International Rice Research Institute (Philippines),  
Agricultural Engineering Department. Bert Orcino. De-  
cember 1972. 33 pages.

PB-225 789

In less developed countries, where increasing food  
production is the goal, the question of whether power and  
equipment are needed is primarily one of what kind and  
quantity. This document is concerned with the econom-  
ic aspects of hand tractor ownership and operation based on  
experience in the Philippines. It analyzes input-output  
relationships on various types of hand tractors and defines the  
relationship between tractor use and costs by the use of  
cost curves. A technical description is given of  
tractors used on Philippine rice farms. Information  
on the tractors were bought and what criteria were  
used in choosing them are included. A comparative  
economic evaluation is made of power tillers, and an  
attempt is made to establish conditions under which  
tractor repayments can be made. Finally, the im-  
pact of devaluation on hand tractor use is examined.

### **Improving Internal Marketing Systems as a Part of National Development Programs**

Michigan State University, Department of Agricultural  
Engineering. Harold M. Riley. May 1972. 29 pages.

PB-225 798

The general theme of the paper is that marketing activi-  
ties take on increasing importance in economic activity  
as countries develop, that effective marketing systems  
do not likely to emerge automatically during the devel-  
opment process so that public policy must facilitate  
marketing changes, that systematic assessment is first  
in formulating marketing improvement programs,  
that particular programs and investments must be  
carefully designed to fit local situations. The information  
is derived from marketing studies in Puerto Rico,  
Brazil, Bolivia, and Colombia through a seven  
year period beginning in the mid-1960's. The primary

purpose has been to examine the marketing systems that  
link large urban centers with their rural supply areas,  
and to formulate recommendations for marketing im-  
provements. The focus is on agricultural marketing.

### **Designing Agricultural Marketing Systems in Developing Countries**

Michigan State University, Department of Agricultural  
Engineering. James D. Shaffer. February 1973. 32 pages.

PB-225 800

The report discusses the design of improved agricultural  
marketing systems for stimulating economic develop-  
ment. The marketing system is seen as an active element  
in the development process, but as unlikely to develop  
automatically into high performance in a given situation;  
development planning has often neglected these consid-  
erations. The theme is that in a traditional agricultural  
economy with low productivity, improved organization  
and coordination of food production and distribution  
systems is critical in the transformation to a scientific  
and industrial economy. Such transformation requires  
adjustment in many parts of highly interdependent sys-  
tem, and it can stagnate as the result of lack of adjust-  
ment anywhere along the line. The role of government is  
called upon to be active rather than passive, to be  
continuous, coordinated, and positive in approach. Some  
of the elements are organized markets, public invest-  
ments, policies reducing price uncertainty, inducement  
by offering contracts, and integrating organizations for  
special commodities. Transportation is very important, as  
well as manpower training.

### **Rural Development Programs for Adaptation from Comilla, Bangladesh**

Michigan State University, Department of Agricultural  
Economics. Robert D. Stevens. June 1972. 80 pages.

PB-225 946

Currently in the developing nations, a number of care-  
fully worked out approaches and experiments are under  
way attempting to accelerate the economic and social  
transformation of rural society without the mistakes of  
attempting to directly transplant foreign models. The  
rural development programs developed at the Academy  
for Rural Development at Comilla, Bangladesh, are one  
set of these experiments. Introductory material and back-  
ground on the Academy and the methods used in devel-  
oping rural programs are presented first. The essential  
elements of six rural development programs organized at  
Comilla are then briefly described. Detailed analysis  
follows of these programs: Improvements in rural govern-  
ment; and development of new agricultural cooperatives.  
Finally, conclusions about the potential of these pro-  
grams for adaptation in other nations are presented.



## **Sources of Agricultural Growth in Japan, 1880—1965**

University of Minnesota, Economic Development Center. Masakatsu Akino and Yujiro Hayami. April 1973. 41 pages.

**PB—225 947**

Throughout the process of modern economic growth in Japan, especially in its early phase, agriculture supported the development of the nonagriculture sector by meeting the food and raw materials requirements of a rapidly expanding economy and sometimes transferring labor and capital to the nonagricultural sector. This experience has frequently been identified as a typical example of the role of agriculture in economic development. In this report, an attempt is made to illuminate the sources of agricultural growth in real output and in the aggregate of real factor inputs in agriculture. For this purpose the technique of growth accounting is used to: (1) Identify the education of farmers and the activities of agricultural research and extension as factors of agricultural production, and (2) employ as the weights of aggregating inputs the production elasticities obtained from the cross-sectional estimates of the agricultural production function.

## **Cropping Regions in India**

University of Minnesota, Economic Development Center. K. William Easter and Martin E. Abel. June 1973. 142 pages.

**PB—225 949**

This document defines crop regions in India for 21 specific crops and three groups of crops. These are: Rice, wheat, jowar, maize, barley, bajra, ragi, millets, pulses, gram, tur, groundnut, coconut, other oilseeds, sugarcane, potatoes, cotton, jute, mesta, black pepper, dry ginger, dry chillies, turmeric, and tobacco. For each crop or crop group there is provided a discussion of the regional aspects of its production, a map showing primary and secondary producing districts, and a table showing regional percentages of total national production.

## **Ryots' Reward: A Study of Production Credit Repayment Programs of Small Farmers in Mysore State, India**

University of Tennessee, Department of Agricultural Economics. Glenn C. W. Ames. June 1973. 234 pages.

**PB—225 951**

India, Mysore State in particular, is an example of a developing economy that needs to rationalize its agricultural credit cooperatives. The central objective of the study is to examine the relationships between the repayment of crop production credit and various characteristics of the sample farms and cooperative societies, as well as

lending policies and administrative procedures of district cooperative central banks in selected areas of Mysore State. Cross-sectional data for a sample of farmer-member-borrowers of 35 primary agricultural credit cooperative societies in Bangalore, Mandya, Myrore Districts of Mysore State in India were obtained through interviews with the farmers (ryots) in 1972. The principal components of the economic analysis are: a description of the organization of Indian agricultural credit cooperatives, identification of the existing cooperative lending practices and borrower difficulties, sources of difficulty the borrowers have encountered in repaying crop production loans, and suggestion of feasible ways to alleviate repayment problems.

## **Ease of Factor Substitution in Agriculture**

Rice University, Program of Development Studies. Wayne R. Thirsk. 1972. 28 pages.

**PB—225 957**

Estimation of the econometric parameters in the analysis of a given economy is hampered by contending school of thought that are created as the result of differing assumptions. The report discusses factor substitution as the basis of one of the more workable investigations of the agricultural sector, with particular reference to the developing nation of Colombia. Some of the principal factors involved are choice of crops, labor input in manufacturing, wage rates, land rents, use of mechanical equipment, marginal cost of production, output prices, and production costs. A mathematical model is presented that contains three factor demand equations, a marginal cost equation, and an equilibrium condition between price and marginal cost. The elasticity of substituting factors is approached by regression analysis, such as considering the substitution of capital for labor or farm machinery for land or labor. Some conclusions are offered that appear to have strong implications for agricultural policies in developing countries. Considerable statistical data are included.

## **Central Bank: International Bank for Reconstruction and Development Farm Mechanization Credit Program: Philippine**

International Rice Research Institute, Agricultural Engineering Department. Ida Estioko. December 1972. 100 pages.

**PB—228 062**

Unlike other modernizing factors in agriculture, such as fertilizers and improved seeds, mechanization represents a somewhat indivisible input, giving rise to contrasting views. It is contended that technological economies result from changes in ownership and use patterns biased toward large farms, and that mechanization patterns are subject to varying degrees to the control of policymakers and managers. The level of indigenous research is especially affected by tariffs, legislation, and credit policies. Ma

Factors are briefly examined, but the focus of the report is on the role of credit in promoting the use of mechanization in Philippine agriculture. The rate and pattern of growth in mechanization during the past several years are discussed. Some of the materials included are the use of four-wheel tractors for single- and double-cropping conditions, hand tractor statistics, acquisition of farm implements for planting, mowing, harvest-spraying, and dusting; and equipment and materials for livestock, poultry raising, and fish culture. The size of loans, interest rates, and the nature and rate of loan use are also discussed.

### **Role of Cooperative Credit in Small Farmer Adoption of the New Cereal Varieties in India**

Ahmed University, Department of Agricultural Economics. Michael G. G. Schluter. May 1973. 43 pages.

PB-228 072

New cereal strains have been developed that provide higher crop yield, improved plant characteristics, and higher financial returns to the farmer, but there are some obstacles to their adoption in various regions of the developing countries. One is a farmer's risk-bearing capacity; another is reluctance to depart from traditional practices; a third is the possibility of increased cultivation costs. The report proposes that in all three situations the role of a cooperative credit system is favorable and important. In the event of adoption of the new strains leading to crop failure, a farmer who has borrowed from a cooperative may still rely on traditional credit facilities until the next harvest. In addition there is flexibility in repayment conditions. The possibilities for cooperative credit in India is discussed in this report, with particular attention to some aspects as yet ill defined. Attention is given to the adoption of a high-yield and a hybrid wheat.

### **Effects of Taxes and Subsidies on Land and Labor Utilization in Nigerian Agriculture**

University of Ibadan, Department of Agricultural Economics. Francis Sulemanu Idachaba. April 1973. 33 pages.

PB-228 245

The paper has the principal objective of providing a framework to examine the effects of government and

marketing board taxes and subsidies on land and labor use in Nigerian agriculture. The approach is through economic modeling in three substudies. The first develops a multicrop production function model, analyzing the effects of taxes on resource allocation where initial quantities of resources are used optimally. The second section extends the model to handle cases in which the initial quantities are not optimized but through errors of organization or forecasting are placed at a level where the market values are between the acquisition and salvage prices. In the third study, guidelines are derived within a production function framework for minimizing allocative distortions in the presence of taxes on marketing board crops. The diversity of Nigerian agriculture includes regions producing groundnuts, food crops, cocoa, oil palm, rubber, and cotton in various proportions. Most farms can be represented by a multicrop production function equation. For conditions of equilibrium involving labor, fertilizer, chemicals, and land holdings in relation to prices, some logarithmic derivations are made. Other production functions are written as partial differential equations. A second-best problem deals with the taxation of crops and with subsidies.

### **Methodology and Problems of Farm Management Investigations: Experience from Northern Nigeria**

Ahmadu Bello University, Rural Economy Research Unit, and Kansas State University, Department of Economics. D. W. Norman. April 1973. 53 pages.

PB-228 404

Until recently, the majority of village studies undertaken in the northern part of Nigeria have been carried out by social anthropologists. Using an anthropological, micro-orientated approach, these studies provide a detailed, descriptive and often nonquantitative account of the communities under study. However, they do not provide the basic quantitative data required by economic planners at the district, state and national levels. Farms management studies are particularly relevant in the northern part of Nigeria where agricultural planning in the 1950's and 1960's was not supported by empirical information for assessing the consequences of alternative strategies and policies. Problems of a wide variety encountered when collecting and analyzing data for farm management surveys are discussed in this report. Some of the topics included are: Village selection; family identification; cooperation of the people; choice of survey period; the effect of seasonal variations; distance, area, quantity, and measurement considerations; crop yield data; mathematical methods for averaging and estimating; and selection and training of the enumerators.



**Indirect Employment and Income Distribution  
Effects of Agricultural Development  
Strategies: A Simulation Approach Applied to  
Nigeria**

Michigan State University, Department of Agricultural  
Economics. Derek Byerlee. 1973. 84 pages.

PB-228 405

The paper explores the interactions of the agricultural  
and nonagricultural facets within an economy in general,  
and evaluates the indirect effects of agricultural develop-  
ment strategies upon the nonagricultural sectors with  
particular reference to output, employment, and income

distribution. A simulation procedure is discussed  
versatile approach to a theoretical and applied an-  
of this type of economic system. A simulation mo-  
then developed to analyze the indirect effects of al-  
tive food and export promotion strategies in the Ni-  
economy. The core of the model is a dynamic 10  
macroeconomic model built on an input-output  
work linked to an employment-incomes model. De-  
obtained on the nonagricultural labor market, mig-  
out of agriculture, and income distributions in the  
lation. An agricultural sector model simulates var-  
of the agricultural sector including policy instrume-  
number of effects are studied, along with some l-  
tions. Several recommendations are evolved.

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## NTIS Best Sellers

**WATEQ, A Computer Program for Calculating Chem-  
ical Equilibria of Natural Waters**  
Geological Survey, Wash., D.C.

Calculates the equilibrium distribution of inorganic aque-  
ous species of major and important minor elements in  
natural waters using the chemical analysis and *in situ*  
measurements of temperature, pH and redox potential.  
The states of reaction of the water with solid and gaseous  
phases are calculated from this model. 1973. 77 pp. PC  
\$4.85/MF \$1.45 order PB-220-464/G

**Effects of Industrial Effluents on Primary Phytoplankton  
Indicators**

Tenn. Univ., Knoxville

Presents a method for an industry to use to evaluate its  
effluent and decide whether it is suitable for emptying  
into the public waterways; can be made satisfactory by  
adjusting the pH; can be made satisfactory by adjusting  
the pH and reasonable dilution with water; or is unsatis-  
factory and can be made suitable only by special treat-  
ment. Presents data on tolerance levels of a few local  
algae to some metallic and other ions. April 1973. 23 pp.  
PC \$3/MF \$1.45 order PB-220-741

**Machine Tool Control Via a Minicomputer**  
Union Carbide Corp., Oak Ridge, Tenn.

Describes a minicomputer control system developed for a  
two-axis machine tool lathe. April 1973. 72 pp. PC \$3/  
MF \$1.45 order Y-1870

**Infrared Photography**

Defense Documentation Center, Alexandria, Va.

Included in this bibliography are citations of re-  
infrared photography and infrared films. Includ-  
surveying, planetary and lunar research, high-s-  
cording with gallium arsenide light emitting diode  
mal mapping, and technology of infrared radiati-  
1973. 126 pp. PC \$5.45/MF \$1.45 order AD-754-6

**Optical Communication Systems. Report of a  
User Meeting at Rice University September 21,  
Rice Univ., Houston, Texas**

Summarizes talks presented at the group meeting  
laser technology, theory, and the range of  
communication technology which includes dete-  
infrared and weak images, materials, optical wa-  
as well as various wave-interaction phenome-  
1973. 93 pp. PC \$4.85/MF \$1.45 order PB-214-77

**Functional Analysis Using Walsh Functions**  
Houston Univ., Texas

Describes a Walsh Function generator, integral  
devices, and a matrix multiplier designed and bu-  
conclusions regarding the limitations and applic-  
the system. Dec. 1972. 62 pp. PC \$4.50/MF \$1.45  
AD-757-350



## AGRICULTURAL TECHNOLOGY

### International Winter Wheat Conference. Proceedings

Department of Agriculture, Agricultural Research Service, Agency for International Development; and University of Nebraska, College of Agriculture. June 1972. 350

219 280

papers submitted at a conference of winter wheat researchers, held in Ankara, Turkey during June 1972, are included in this document. The topics covered include: problems and opportunities for increased winter wheat production in Turkey; winter wheat improvement problems in Western Europe, Eastern Europe, Near East, North Africa, Far East, and USA; specific adaptation of winter wheat; the case for general adaptation; fertilization of fall-planted spring wheat under irrigation; fertilization of nonirrigated wheat in regions of moderate and low rainfall; photoperiodism and cold tolerance in winter wheat; limiting factors in wheat adaptation; winter wheat summer fallow research in Central Asia; nutritional improvement research and evaluation programs; opportunities in the nutritional and agronomic improvement of wheat; role of international research institutes in winter wheat evaluation; germ plasm and future wheat improvement; the International Winter Wheat Performance Nursery; nursery winter hardiness problems; dissection problems; milling and baking quality of varieties developed in Sweden; association of characters in varieties grown in Germany; relationship between and some components of varieties grown in Italy; determination of gluten and swelling number in Austria; results of International Winter Wheat Performance Nursery trials in Czechoslovakia, Bulgaria, Turkey, Iraq, India, Brazil, Chile; triticale; hybrid wheat breeding; mildew population in Italy and breeding for mildew resistance in winter wheat; autumnized Mexican spring wheat in Hun-

### Program Development

Mississippi State University, Seed Technology Laboratory. James C. Delouche and Howard C. Potts. June 1972. 130 pages.

219 531

Improved seed varieties have come to the forefront in the program for agricultural improvement in many developing areas. Old seed programs are being refurbished and expanded to produce the quantities of seed needed of the improved varieties. New seed programs are being initiated.

Experience has shown that the major problem in establishing a seed program in the less developed countries is an incomplete understanding or concept of just what a seed program is and what it is not. Most of the other difficulties and problems derive wholly or in part from this misunderstanding. This handbook represents an attempt to place the total seed program and its various components in proper perspective relative to agricultural improvement in general. Consideration is given to: Planning the seed program; organization and initiation of a seed program; financing the program; seed release and multiplication; harvesting and drying; seed processing; seed storage; quality control and evaluation; seed legislation and control; seed distribution and marketing; training and education; and program evaluation.

### Alternative Sources of Protein for Animal Production. Proceedings of a Symposium

National Academy of Sciences; and American Society of Animal Science. 1973. 184 pages.

PB-224 427

This document is comprised of papers presented at a symposium held in July 1972 at Virginia Polytechnic Institute. The symposium sought to examine some of the issues arising from the question of protein supplies needed to meet the food needs of the world's expanding human population. In particular, the fact that in exploiting animal proteins for human consumption, sources of protein for animal production may, in turn, be limiting. In addressing this issue, the symposium explored measures for enhancing protein supplies from known proteinaceous feeds and then identified and evaluated certain new sources. Specific topics dealt with include: Improvement of quality and quantity of cereal grain protein; separation of protein from fiber in forage crops; developments in processing of meat and blood byproducts; advances in oilseed protein use; investigation of plants not currently used as major protein sources; technological developments in fish processing and implications for animal feeding; production of single-cell protein from solid wastes; and recycling animal wastes as protein sources.

### Drying and Processing Research at IRRI

International Rice Research Institute (Philippines). A. S. Manalo, J. R. Arboleda, and A. U. Khan. August 1972. 25 pages.

PB-225 787

In the countries of Southeast Asia, with about 50-70% of the population in rural areas, much of the rice consumed is processed with the traditional methods and with obsolete equipment. This usually results in high losses of grain and the end product is often unhygienic. The development of low-cost farm drying and processing equip-

ment that would be suitable for use and manufacture in the developing countries may therefore be considered an urgent necessity. Very few attempts have been made in this direction by private manufacturers. Research and development of low-cost rice drying and processing equipment for small-scale operation is one of the important areas of activities at the International Rice Research Institute (IRRI). This document describes the progress achieved in this area. Consideration is given to the production of a low-cost, functional, and durable batch-type grain drier; a furnace for the drier fueled by rice hulls; heated-sand conduction drying and parboiling equipment; a direct flame, continuous flow drying process; and improved rice milling equipment.

### **Nitrogen Fertilization and Management in Tropical Rice**

North Carolina State University, Agricultural Experiment Station. Pedro A. Sanchez. November 1972. 33 pages.

**PB-225 801**

Rice responds almost universally to nitrogen fertilization and with less frequency to other elements. The magnitude of these responses is of great practical importance. This document summarizes the present knowledge about the history and practice of nitrogen fertilization in rice in relation to prevailing water management and cultural practices common in tropical Latin America. The topics covered include: The effects of constant flooding, intermittent flooding, and puddling on nitrogen dynamics in rice soils; nitrogen response and factors affecting it, including plant type, solar radiation, growth duration and temperature, water management, cultural practices, and soil properties; formulating nitrogen recommendations to farmers; nitrogen sources for constant flooding and for intermittent flooding; methods of nitrogen placement; timing of nitrogen application under constant flooding and under intermittent flooding; recovery of applied nitrogen.

### **Upland Rice Improvement Under Shifting Cultivation Systems in the Amazon Basin of Peru**

North Carolina State University, Agricultural Experiment Station; Peruvian Ministry of Agriculture. Pedro A. Sanchez and Marco A. Nurena S. July 1972. 23 pages.

**PB-225 802**

Agriculture in the Amazon Basin is based almost entirely on a shifting cultivation system in which rice and other crops are grown after clearing and burning a forest after which the fields are abandoned to the fast forest regrowth. Although less than 20% of Peru's rice is presently produced in this region, its vast potential in view of forthcoming road connections with the rest of the country and with Brazil prompted the initiation of a

research project on upland rice improvement. This report summarizes the results of the first 19 months of this project. The work included trials with 349 different rice varieties, comparison of various planting methods, fertilization experiments, and a continuous cropping experiment.

### **Establishing Design Criteria for Improved Rice Milling Technologies**

International Rice Research Institute (Philippines). Cultural Engineering Department. Bart Duff and Estioko. August 1972. 30 pages.

**PB-225 803**

This paper is concerned with the problems of modernizing and upgrading the rice milling industry. More specifically, it attempts to critically assess the efficiency and economics of existing rice milling technologies. The analysis is confined principally to milling equipment. A description is given of existing milling technologies in the Philippines. Some important structural characteristics of the rice processing in the Philippines are examined, and an economic evaluation is made of native milling systems. Finally, an effort is made to synthesize the results into a series of recommendations relating to research on the design, development, and optimization of milling equipment.

### **Manual de Metodos de Investigacion de Maleza**

Oregon State University, International Plant Protection Center. W. R. Furtick and R. R. Romanowski, Jr. 1973. 90 pages. (Text in Spanish)

**PB-228 290**

Economic losses and production setbacks due to weeds are now major considerations for many nations seeking agricultural self-sufficiency. Weed control, particularly by establishment of exhaustive weed research programs, is recognized as an inseparable part of a meaningful cultural program. This handbook on weed control research techniques and methods is intended as a guide to help prevent some common mistakes associated with weed control field research. Emphasis is on procedures associated with establishing new programs. The reader is assumed to have some field experience or background in agricultural research. Subject matter covered includes: Cultural practices for experimental plots; weed control experimental procedures; experiments designed to achieve stated objectives; determination of economic aspects of herbicide use; applicators for use in chemical weed control research; evaluating and reporting weed response to herbicides; evaluating crop response to herbicide treatments; precautions in herbicide work; formulation and evaluation of chemicals. (An English-language version of this manual is also available as PB-219 663. See PB-219 663, May 1974, page 15.)



## **Production of Maize**

Tennessee Valley Authority, National Fertilizer Development Center. May 1971. 108 pages.

228 304

This document contains citations and abstracts for 653 citations from the world's literature on the use of fertilizer on maize. The entries are grouped according to crop; the period covered is 1964-70. Subject and author indexes are included.

## **Sulfur-Coated Urea: Status, Evaluation, Recommendations**

Tennessee Valley Authority. July 1972. 29 pages.

228 309

The Tennessee Valley Authority has developed a dramatically improved nitrogen fertilizer, Sulfur-Coated Urea (SCU). Through controlled release of its nitrogen component and improved physical characteristics it promises a number of advantages. SCU will reduce any hazard to the environment posed by conventional fertilizers; lead to more efficient use by crops of applied nitrogen; and overcome problems in handling, shipping, and formulating blended fertilizers. Its cost should be competitive with conventional nitrogen fertilizers for many uses. This document provides an assessment of the status of SCU, an evaluation of its market potential and benefits that might be derived from its use, and recommendations for the next step in developmental production and introduction. More specifically, consideration is given to the nature of SCU and its mode of action, process and production technology, estimated production costs, environmental benefits, agronomic benefits, product quality benefits, analysis of market potential and possible returns from SCU, and potential industry production of SCU.

## **The Best from MCIC**

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- Coatings with metal or ceramics.
- Mechanical treatments such as shot peening, machining.

1971. 73 pp. PC \$7.50/MF \$7.50 order AD-732-248/G

**Superalloys—Processing**—Contains more than 500 pages of information on the processing of superalloys. Gives you the full texts of the 28 papers presented at the Second International Conference on Superalloys—Processing. Highlighted in this well-illustrated volume:

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- Powder metallurgy

1972. PC \$21.95/MF \$21.95 order AD-748-159/G



## BUILDING TECHNOLOGY

### **Tolerance of Buildings to Differential Settlements**

Massachusetts Institute of Technology, Department of Civil Engineering. Rebecca Grant, John T. Christian and Erik H. Vanmarcke. December 1972. 68 pages.

COM-73-11325

The report deals with the response of buildings to foundation settling. Results are given of a literature search conducted during the initial phase of a study of tolerances of buildings to differential foundation settlements. Records of settlement related performance of buildings are analyzed, and limits for allowable settlement are suggested where adequate data are available. Most of the data are in graphic and tabular form. The text covers the analysis of damage to a particular building, review of criteria, mathematical relationships of settlement, field data on allowable and maximum settlements, evaluation of the curvature parameter, and effect of the rate of settlement on the degree of damage.

### **Design, Siting, and Construction of Low-Cost Housing and Community Buildings to Better Withstand Earthquakes and Windstorms**

National Bureau of Standards, Center for Building Technology. William F. Reys and Emil Simiu. January 1974. 153 pages.

COM-74-50184

Earthquakes and windstorms are responsible for great loss of life and property throughout the world. Improved design, siting, and construction procedures for housing can contribute significantly to the reduction of such losses. In developing countries, however, cultural patterns, severe socioeconomic constraints, and inadequate technical expertise make the adoption and implementation of such procedures particularly difficult and are thus an indirect cause of continued losses on a massive scale. Consideration is given in this monograph to the potentials of applying housing technology to mitigate earthquake and windstorm disasters in developing countries and to relevant socioeconomic and cultural constraints. An examination is made of existing knowledge relevant to the design, siting, and construction of earthquake and windstorm resistant buildings, including recent technological innovations applicable within the developing countries. Promising innovations are evaluated in the light of consultations and onsite case studies in Peru, Turkey, and the Philippines. Technical and socioeconomic constraints concerning construction in earthquake and windstorm areas in developing countries are identified. Alternative approaches to overcome technological and socioeconomic barriers to more effective building practices are described.

### **Cost Reduction Methods for High-Rise Apartments**

Pratt Institute, School of Architecture. January 1968. 100 pages.

PB-219 111

A project was initiated to demonstrate that significant reductions in the cost of high-rise housing for low and moderate-income families may be achieved by the use of existing materials along with techniques not heretofore used in construction. Basic concepts are these: Savings can result from reinterpreting certain unnecessarily restrictive code provisions that are unrelated to safety hazards; and costs may not be cut through low levels of safety or livability but by increasing the efficiency of techniques and materials. A test building was constructed to study innovative measures, and used to investigate many selected components of structural closure, finish, and mechanical operation. Of particular interest was use of the stacked prefabricated concrete for room design, as well as the gypsum board wall, hollow or sandwich. Acoustic and fire tests are described. Included were concern for positive architectural and social values. To gain accurate price information, preliminary drawings and specifications were prepared for three apartment building schemes and given to contractors for bid-type pricing. Other items studied included various steel structures, precast concrete panels, exterior wall panels, aluminum sandwich exterior resilient floors, rafts, wiring, combined waste and plumbing, and radiant balance heating.

### **State-of-the-Art on Durability Testing of Building Components and Materials**

National Bureau of Standards, Center for Building Technology. Larry W. Masters, Winthrop C. Wolfe, et al. March 1973. 129 pages.

PB-222 300

Aging as applied to materials and systems refers to change with time in chemical or physical properties resulting in decreased performance capability. Important factors in the aging process are climatic exposure, sustained and cyclic stresses, faulty construction or installation, in appropriate usage, and physical abuse. Prediction of aging rates and effects is necessary to estimate maintenance costs, repair frequency, and replacement. Accelerated aging, a means to such prediction, is the prediction in a much shorter time the changes that would occur in real time of extended duration. The report is a summary of present knowledge pertaining to durability predictions for building components and materials that are subjected to the effects of outdoor exposure. Discussions are centered on the nature of aging, measurement of properties to predict durability, nondestructive testing, outdoor exposure techniques, accelerated aging methods, interpreting test data, and difficulties that arise in making predictions.

## **Experimental Industrialized Housing Program. Model H-620: Single-Family Housing**

to Rico Urban Renewal and Housing Administra-  
September 1972. 19 pages.

224 411

construction of prefabricated modest housing, com-  
posed of wood and assembled at the residence site, has  
provided a solution to the housing needs of a large segment  
of the low-income population. In addition, the new con-  
struction has sparked increasing search for innovative indus-  
trialized systems that would use diversified construction  
materials and combinations of materials. The report  
describes an innovation that can reactivate a portion of the  
construction industry, which has stagnated during the  
last 20 years but that possesses molds, transport trucks,  
cranes, and allied equipment that were formerly used to  
construct concrete units with medium sized panels. The  
construction consists of reinforced concrete house walls  
and an asbestos cement roof. The innovative feature  
of the main focus of the report consists of construction  
of the wall slabs in their natural state instead of on  
artificially filled terrain. It is proposed that this con-  
struction should obtain acceptance by the majority of the  
housing market for permanent structures. The  
construction has a longer life span than other types of modest  
housing and therefore permits the use of long term  
warranty insurance. Moreover, the units are easily and  
economically maintained, are resistant to fires and incle-  
weather, and repel termites.

## **Deformations and Critical Loads of Steel Beams Under Fire Exposure Conditions**

National Swedish Institute for Building Research. Jorgen  
Thor. 1973. 123 pages.

PB-227 257

An estimation of the loadbearing capacity of steel struc-  
tures when exposed to fire requires knowledge of  
strength properties and deformational characteristics of  
steel under flame conditions. Published data on the  
relations between high temperature yield stress or the  
0.2% proof stress and temperatures have differed consid-  
erably, even for same or similar grades of steel, perhaps  
from creep effects on the stress-strain curve. Another  
cause for discrepancies may be uncertainty in assessing  
the slope of the tangent at the origin to a stress-strain  
curve in high-temperature tests. Thus a need exists for a  
better criterion. The report discusses a method for im-  
proved estimation of load bearing based on deformation  
of a beam during a fire. A model is described for calcula-  
tion of this deformation, derived from tensile tests at  
elevated temperatures and performed at such high rates  
of loading that creep strain may be considered as negligi-  
ble. The tests are discussed and the results are compared  
with calculated values. An examination of critical loads  
is included.

## **The Best from NSIC Nuclear Safety Information Ctr.—**

**Radiography Incidents and Over-Exposures**—Contains  
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sponse, personnel, operating, and management errors in the  
radiography. 1972. 84 pp. PC \$10/MF \$10 order  
ORNL-NSIC-53/G

**Estimation of Doses Due to Accidentally Released Plu-  
tonium from LMFBR**—Reviews experimental data and  
mathematical models which can be used to assess the transport  
of plutonium aerosols following a hypothetical  
accident. Covers:  
• Behavior of Released Sodium Oxide and Plu-  
tonium-Bearing Particles  
• Transport, Settling, and Redistribution of Aero-  
sols in the Outside Air (Troposphere)  
• Chemistry of Plutonium

- The Intake and Metabolism of Plutonium Dioxide
- The Computation of Internal Dose

1972. 123 pp. PC \$15/MF \$15 order ORNL-NSIC-74/G

## **Design Data & Safety Features of Commercial Nuclear Power Plants Vol. 11, Docket No. 50-296 through 50-395**

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- Site Features
- Circulating Water System Data
- Miscellaneous factors.

An aerial perspective is also presented for each plant site  
showing relation of plant to cooling water intake and dis-  
charge and other environmental factors. 1972. 282 pp.  
PC \$15/MF \$15 order ORNL-NSIC-55/G



## CHEMISTRY

### Fixed and Fluidized Beds: An Introduction

Naval Ordnance Laboratory, Chemical Engineering Division. Barry G. Pallay. December 1973. 46 pages.

AD-773 740

This document explains what fixed and fluidized beds are, where they are used, and some of the basic concepts necessary to understand their operation. The principles of momentum, heat, and mass transport as they apply to these systems are outlined, along with basic design equations and theoretical modeling. Fluidized beds in particular are widely used in industry to perform a wide variety of important functions, but are relatively unknown by the general technical community. The intent of this review is to explain enough about these systems so that their potential usefulness may be appreciated and harnessed, and so that the current state-of-the-art can be quickly assessed.

### Fluoride Determinations in Water

Environmental Protection Agency, Water Quality Office. D. H. Gunderson, T. N. Hushower, et al. 1971. 50 pages.

PB-217 774

This document is intended for use as a training and reference manual for individuals directly involved in performing fluoride determinations on drinking waters. Preliminary discussions deal with the public health aspects of water fluoridation, engineering aspects of water fluoridation, and safety and hazards in handling fluorides. The technical portion covers: Calculation of fluoride feed rates; colorimetric analysis; chemistry of fluoride analysis; Scott-Sanchis fluoride analytical procedure; Spadns fluoride analytical procedure; electrode analytical procedure; use of instruments; control of interfering ions; fluoride laboratory.

### Low-Temperature Lignite Tar: Processing and Utilization

Bureau of Mines, Morgantown Energy Research Center. John S. Berber, Richard L. Rice, and John D. Spencer. 1973. 69 pages.

PB-220 470

The low-temperature carbonization process for coal was originally developed as a means for producing char, a coke-like material with many potential uses. One of the factors having a bearing on the economic attractiveness of the process is finding uses for the low-temperature tar

that is produced as a byproduct. This report describes results of investigations of the yields and physical and chemical properties of these tars. It also describes some processing and use of the pitch, acids, and neutrals that are produced by distillation of the tar. Some products that were obtained were: Phenol, cresols, xylenol from the acids; phthalic and maleic anhydride from the aromatic and naphthalene fractions; neutral oil; alkylbenzene sulfonates, suitable for use as a biodegradable detergent, from the paraffins and naphthalene of the neutral oil; jet engine fuel from the aromatic component of the neutral oil; carbon black and aluminum-lurgical electrodes from the pitch. Descriptions and data sheets are given for each of the above processes, and the potential commercial utility of each is discussed.

### Chemical Analyses for Water Quality

Environmental Protection Agency. Audrey E. Dorris. February 1973. 394 pages.

PB-224 212

This document is intended to be used as a training manual or reference source for chemical analysis of natural waters, public water supplies, and water for agricultural and industrial uses. Emphasis is on the detection of pollutants and the maintenance of water quality. The topics covered include: Water resource needs; water quality criteria; data collection and evaluation; standard solutions; acidity, alkalinity, pH, buffers; oxygen tests; analysis of nitrogen, carbon, and other nutrients; instruments and inorganic analysis; instruments and organic analyses; water quality sampling; sample handling; laboratory procedures.

### The Chemistry of Gypsum and Its Dehydration Products. Vol. 2. The Physicochemical and Mechanical Properties and Analysis of the Phases. Part 5. Thermometric Methods of Analysis

Stanley E. Edinger. October 1973. 406 pages.

PB-224 317

This volume is part of a multivolume work on the chemistry of gypsum and its dehydration products. The entire work is intended to serve as a comprehensive coverage of the international literature, dating from antiquity to the present, on this important mineral building material. Volume 2, part 5 covers the thermometric methods of analysis of the calcium sulfate phases. More than 350 references are provided to the world literature on the subject, the majority of which are accompanied by an English-language abstract. Also included is a review paper titled "Theoretical Analysis of Solid State Thermal Decomposition Reactions."



## Demetallization of Heavy Oils

Carbon Research, Inc. William C. Rovesti and Ronald I. Wolk. December 1973. 143 pages.

227 568

Large crude oil reserves exist in the world that have high sulfur contents and contain nickel and vanadium contaminants in high enough concentrations to greatly poison hydrodesulfurization catalysts. This condition makes it economically unattractive to desulfur-

ize the residual fraction of these crudes. Screening tests of number of catalyst promoters have now indicated that 20×50 mesh activated bauxite, impregnated with two weight percent molybdenum, provided a catalyst with greatly improved demetallization activity, reasonable stability to poisoning, and relatively low cost. Present day commercial hydrodesulfurization catalysts cost between \$0.85 and \$1.50 per pound in the US. It appears that the new catalyst can be sold for about \$0.20 per pound. The preparation, use and economics of the new catalyst area described in this report.

## NTIS Best Sellers

### Port Terminal System Concepts. Part I. Evaluation of Elements & Capabilities for Determination of the Need for Offshore Terminals

Associates, Inc., New York

the analysis of U.S. bulk commodity imports & exports, ocean transportation costs & trends in ship size, characteristics of bulk cargo ports and discusses need for additional deepwater terminal facilities. 1972. 249 p. \$3.50 COM-72-11372

### Port Terminal System Concepts. Part III. Formulation of Advanced Concepts for Offshore Terminals

Associates, Inc., N.Y.

selection costs, environmental impact, design criteria and economic justification. 1972. 243 p. \$6.75 COM-72-11374

### Minimum Needs for Airport Fire Fighting and Services

Cohn and John A. Campbell, Abcock and Associates, Inc.

minimum standards for airport fire-fighting and services for different categories of airports. In-quantities and application rates for fire extinguishers, number of transport vehicles, response times, and related elements. 1971. 97 p. \$3 AD-720 512

### Estimation of Air Pollutant Emission Factors

Environmental Protection Agency

emission data obtained from source tests, material balance studies, engineering estimates, etc. Covers most of common emission categories—fuel combustion by stationary and mobile sources; combustion of solid wastes; emission of fuels, solvents, and other volatile substances from various industrial processes; and miscellaneous sources. 1972. 167 p. \$3 PB-209 559

### Transoceanic Cargo Study. Vol. II. Distribution Costs and Productivities of Transoceanic Transport Technologies

Planning Research Corporation, Los Angeles, Calif.

Presents the costs and productivities of the transoceanic transport technologies for the years 1970-1980. Includes the B-747F/L-500 type jumbo cargo aircraft for the air mode and representative configurations of Bulk carriers, Tankers, Container Ships, Break-Bulk Ships, and Barge Carriers for the ocean mode. Considers the domestic and foreign inland modes and to peripheral costs—documentation, inventory, pickup & delivery, and insurance. 1971. 173 p. \$3 PB-201 041

### Guidelines for Deck Stowage of Containers Vol. I, Vol. II Appendix

Henry (J.J.) Co., Inc.

A two-volume handbook for the ship designer, ship operator and container operator. Guidelines for securing and protecting cargo containers carried on the weather deck of ships: reducing ship motions; sea impact; container location and cargo security. Includes sample calculations. The appendix summarizes data from damage reports. Also analyses mathematically ship accelerations and forces which damage containers and reviews existing container standards. 1970. 2 vol. \$6 COM-71-00022-SET

### Special Study—Risk Concepts in Dangerous Goods—Transportation Regulations

National Transportation Safety Board, Wash., D.C.

Includes an example of a type of framework which might be used for effectively guiding the risk identification, evaluation, and reduction processes for dangerous goods transportation. 1971. 35 p. \$3 PB-198 264

## CIVIL ENGINEERING

### Shear Strength of Tropical Soils in Relation to Composition and Environment

Iowa State University, Engineering Research Institute. R.A. Lohnes, T. Demirel, et al. May 1973. 82 pages.

AD-762 364

Results and interpretations are given of engineering tests, strength and density measurements, and mineralogic studies of 10 tropical soils representing various states of weathering. It is shown that standard classification systems used for temperate soils tend to underestimate the engineering behavior of undisturbed lateritic soils. At high normal stresses the shear-stress deformation curves are similar to normally consolidated clays, whereas at lower normal stresses they are shaped like the curves of over-consolidated clays. For a given parent rock, the void ratio decreases and cohesion increases as weathering proceeds. The specific gravity of the soil appears to be a promising parameter for the engineering characterizations of lateritic soils weathered from a given parent rock, insofar as it reflects iron oxide content. There is a decrease in void ratio and increase in cohesion with increasing specific gravity, which suggests a model for the engineering classification of tropical soils.

### Electromagnetic Pulse Sounding for Geological Surveying with Application in Rock Mechanics and the Rapid Excavation Program

Ohio State University, Electro Science Laboratory. D. L. Moffatt, R. J. Puskar, and L. Peters Jr. September 1973. 172 pages.

AD-772 065

A new device under development for the detection, diagnosis, and identification of geological and manmade anomalies beneath the earth's surface is the electromagnetic pulse sounding probe. It is basically an active remote sensor capable of interrogating a material medium from the surface of the medium, to estimate in situ frequency-dependent electrical properties. The report discusses the main goals of investigation: to obtain full scale field measurements of such geological hazards to deep tunneling as faults, joints, and lithologic contrasts; to devise techniques for determining the frequency-dependent characteristics of underground rock, and to develop theoretical analyses and computer programs to obtain realistic calculations of the pulse response of geological-type targets. The full-scale version of an electromagnetic pulse sounding probe is described with attendant experimental data. Measurements in limestone and dolomite are reported and discussed. Probe calibration procedures are included, and some indications are made for further research.

### Protection of the Environment During Demolition Activities

Army Engineer Waterways Experiment Station. Skinner, L. Miller, and W. Harvey. December 1972. 10 pages.

AD-772 920

When demolition activities occur in urban settings it is necessary to ensure that the environment is properly protected during the demolition process. This report describes the development of new demolition techniques that would minimize hazards to the environment. Some of the pollution problems associated with nonexplosive demolitions are dust, smoke, noise, water pollution, and solid-waste disposal. Problems from explosive demolitions are fumes and other products, airblast effects on building components, especially window breakage, ground motion, ejecta or thrown solids; noise; and vibration. Some recommendations are made for regulatory control for selection of demolition methods, and for pollution control.

### Percussive Water Jets for Rapid Excavation

Scientific Associates, Inc. Eugene B. Nebeker and E. Rodriguez. December 1973. 60 pages.

AD-772 931

Among the innovative processes being considered for rapid rock excavation and earth digging is water jet impingement. This report describes the percussive action of a free water stream that becomes axially discontinuous before hitting its target so that discharge momentum is applied in a sequence of high frequency, short duration impacts instead of as a steady force. Water hammering at high lateral velocities enhance fracturing and excavation. Since opening and closing the jet is impractical, a new concept is advanced—the modulation of jet discharge by cyclically increasing and decreasing the rate by a small amount, obtained by varying flow resistance upstream of the discharge nozzle. Rock impact tests using small specimens of granite, limestone, and sandstone are described and discussed. Some favorable results are obtained as well as some advantages of hydraulic excavation. Energy is applied continuously rather than cyclically in blasting. The jets need no massive equipment for support backthrust as in boring, and disassembly is easier. Water jets are adjustable to varying forms and for excavation size. Negligible dust is produced, avoiding respiratory and explosion hazards. Unlike hydraulic excavation has not been widely used, primarily because of less efficiency plus the problem of slurry drainage. Some indications are made for further development.



## **Investigation of Thermal-Mechanical Fragmentation of Hard Rock**

University of Missouri, Rock Mechanics and Explosives Research Center. G. B. Clark, T. F. Lehnhoff, et al. December 1973. 209 pages.

772 987

Extensive research is currently being conducted on the fragmentation of hard rock for rapid excavation of underground structures such as tunnels and mines. The report describes a laboratory research method of fracturing 30 in. cubes using internal heat from a coiled wire resistive unit or a carbon arc. The methodology includes measuring the heat at the rock surface, at the base of slots cut into the formation, and from bore holes. Finite element studies are described of temperature and thermal stress distributions. A concept under development is one in which a tunnel round is drilled pneumatically and the heat fractures the rock as by an explosive round. Expected rates of advance and costs per foot are seen as favorable.

## **Ground Support Prediction Model (RSR Concept)**

Woodward-Lundgren & Associates. George E. Wickham and Henry R. Mann. January 1974. 271 pages.

773 018

There is great need for ground support innovations in underground excavation, especially a means of predicting rock loads in advance of actual construction. A methodology must be developed for determining safe, efficient, and economical ground support design practices. The report discusses one approach to predicting tunnel support requirements in the preconstruction phase, based on geologic investigations and construction data such as opening size and shape, direction of drive, method of excavation. Data from 33 tunnel projects were used to formulate a tentative prediction model to be used in the Rock Structure Rating (RSR) a measure of the ability of a rock mass to support itself around a given opening. Twenty additional case studies aided in the development of a modified and expanded prediction model, presented and discussed. Results of field investigations in six on-going tunnel projects using the revised prediction model are given and analyzed. Some indications are made for future developments.

## **Application of Military Guns to High-Speed Tunneling and Excavation in Rock—Project M**

Woodward-Lundgren & Associates. J. D. Watson. January 1974. 56

773 649

Extensive exploratory methods are being advanced for tunneling in rock. This report describes the use of

military guns, using conventional military propellants to launch solid projectiles of concrete or steel, for this purpose. There were two objectives in a joint demonstration program. The first was a high speed field test in which 90mm and 105mm guns mounted on an Army carrier were used to drill holes, drive tunnel, make a cut in a surface outcropping, and break large boulders. A silencer was developed for the 90mm operation was tested underground for tunneling and mining applications. The process included effective means of clearing the 16 in. diameter hole obtained in hard rock with advanced rates up to 12 in. per shot. It is concluded that a highly mobile cannon drill can be engineered for rock excavation using a simple excavation projectile with existing military hardware.

## **Development and Applications of Theoretical Methods for Evaluating Stability of Openings in Rock**

Woodward-Lundgren & Associates. Chin-Yung Chang and Keshaven Nair. December 1973. 209 pages.

AD-773 861

Excavation of an opening in a rock formation is known to create disturbance in the rock mass surrounding the opening. The zones of loosening and fracturing, as well as the depths of overbreak around the opening, will be different according to the excavation techniques of drilling and blasting, smooth wall blasting, or boring. If simulation models of excavation technique effects are to be constructed, some essential features must be included: the stress-free excavation face, and the disturbed zone in the vicinity of the excavation. The report provides the results of work undertaken to incorporate into a finite element computer program the capability to model tunnel structural supports and excavation sequences, and to evaluate the developed model by means of a study of case histories. Consideration is given to available excavation information, mechanisms of ground support, formulation of computational models, modification of the computer program to incorporate the computational models, and analysis of documented model tests and case histories of underground openings. Analysis of a particular passenger transportation tunnel is given.

## **Correlation of Seismic Velocities with Earthwork Factors**

State of California Division of Highways, Materials and Research Department. Travis Smith, Marvin McCauley, et al. November 1972. 30 pages.

PB-219 252

An important objective of a large earthwork project is to place into the embankment all the material that is excavated. This would be possible if the effect of varying types of materials, subsidence of original ground, different construction methods, degree of compaction, unseen



deviations from designed slopes, and shrinkage and swell of the excavated material were predictable. The increase and decrease of the excavated material can be taken into account by applying an earthwork factor. The earthwork factor is a ratio expressing the number of cubic yards of embankment resulting from one cubic yard of excavation. This document provides information needed to evaluate the validity of earthwork factors obtained from seismic refraction velocities on igneous, sedimentary, and metamorphic rock. It is shown that there is a reasonable correlation between seismic velocity and earthwork factor for the various types of rock studies thus far. Graphs are presented showing this relationship. Although it is improbable that an exact method can be developed for estimating the design earthwork factor, the use of seismic data appears to show considerable promise in yielding reliable information of this kind.

### **Adap—A Computer Program for Static and Dynamic Analysis of Arch Dams**

University of California, Earthquake Engineering Research Center. Ray W. Clough, Jerome M. Raphael, and Soheil Mojtahedi. June 1973. 184 pages.

**PB—223 763**

Arch and crown cantilever analysis of dams take into account the interaction between arches and vertical elements in the dam, and has developed into trial load analysis recognizing different degrees of interaction between vertical and horizontal elements, depending on dam geometry. The latter method has benefited in time and work saving by computer technology. Development of a finite element computer program for linear static analysis and dynamic earthquake response analysis of arch dam foundation systems is described. The program uses most of the logical features of the Sap computer program, covering three different element types. Special numerical procedures are included which have proved very efficient. The program is applied to response analysis of a selected dam.

### **Soil Shear Strength**

Federal Highway Administration, Offices of Research and Development. Stephen F. Obermeier. June 1973. 37 pages.

**PB—223 946**

For designing a structure upon a consolidated or slightly overconsolidated clayey soil, determination of the undrained shear strength in a triaxial type of test provides the engineer with a strength value that is reasonable and conservative. Since it is not always feasible to acquire undisturbed samples in weak or sensitive soils a field vane shear device appears to offer a simple expedient for obtaining realistic strength values. However, field vane shear strengths of clay soils frequently differ from triaxial compressive shear strengths, so a laboratory vane

apparatus was developed to investigate the discrepancy. A motor driven device using four- and six-bladed vanes was tested. The soils varied from sandy silts to clays of high and medium plasticity. Specimens were formed by hand rodding, compacting with a Vicksburg rammer, and consolidating from artificial slurries and sediments. Data obtained indicate that the measured shear strength of a clay soil is dependent on the test speed, presumably a function of the two independent variables of effective stresses and shear strength properties. A possible use for the laboratory type of vane apparatus is discussed.

### **Shear Strength of Fine-Grained Soils**

National Research Council, Highway Research Board. C. Chang, W. J. Eden, et al. 1973. 67 pages.

**PB—227 031**

Six papers are presented on the measurement of fine-grained soil strength and allied indicative parameters. The use of the data in construction management is illustrated. The papers deal with a case history of foundation failure in an embankment, landslide, in sensitive marine clay, shear strength increase in a soft foundation clay, landslide, in a fill foundation, a method of determining strength parameters of soils, and characteristics of some clay soils. Some of the topics discussed are construction control instrumentation placement, location of transportation routes in landslide areas, sand effects, peat consolidation, and time considerations.

### **Draft Tubes of Hydroelectric Stations**

Bureau of Reclamation; and National Science Foundation. M. F. Gubin. 1973. 257 pages. (Translated from Russian by Jagan Motian from *Otsasyvayushchiesya gidroelektrostantsii*, Moscow, 1970.)

**TT—72—52000**

The energy output and cavitation index of hydroelectric turbines are influenced by their draft tube design, which determines also machine room factors in the power station. The book reviews recent developments in the design and construction of draft tubes throughout the world. Data regarding design, construction, and operation are presented, including the effects of these variables on capital investment and operating costs of hydroelectric power stations. Until now, curved draft tubes have been widely used in turbines with variable angle guide vanes and mixed-flow characteristics. New methods of designing machine rooms are necessitating the development of new types of draft tubes. Improvement in rotor design involved a change in the flow characteristics at the rotor. With connection to large power grids a shift in operating regimes, leading to a change in draft tube dimensions. A summary is given of experimental and theoretical research on various types of the tubes.

## CONCRETE (NONBITUMINOUS)

### Compression Characteristics and Structural Design Analysis of Steel Fiber Reinforced Concrete

Construction Engineering Research Laboratory. Gilbert  
Williamson. December 1973. 43 pages.

771 908

This report deals with reinforced concrete composed of  
concrete containing randomly dispersed steel  
fibers of short length and small diameter. Although the  
concept has appeared promising, most research on it  
has been directed toward improving the tensile and  
flexural strength since plain concrete is deficient in these  
properties. At the time compressive strength tests have  
been conducted widely varying and inconsistent results, so that  
predictions of fibrous concrete utilizing compression  
characteristics have not been developed as have those  
for flexural properties. The objective of the reported  
study has been to determine the effect of steel fibers upon  
compressive strength of concrete and mortar.  
The data are then used with shear data reported  
elsewhere to justify from a compression standpoint the  
use of steel fiber reinforced concrete in conventionally  
reinforced flexural members such as beams. The effect of  
fibers on ductility, Young's modulus, and Poisson's  
ratio is discussed, including the effect of test cylinder size  
on the compressive strength findings. A cost comparison  
is made between a conventionally reinforced beam  
with shear reinforcement and a similar beam with steel  
fibers instead of shear reinforcement.

### Concrete-Polymer Material and Its Worldwide Development

Lehigh National Laboratory, Department of Applied  
Science. Meyer Steinberg. December 1972. 14 pages.

17548

The development of concrete-polymer composite materials  
is directed at both improved and new concrete  
materials by combining the ancient technology of hydraulic  
cement concrete formation with the more modern  
technology of polymer chemistry. Polymer impregnated  
concrete is the most developed of the composites  
and exhibits the highest degree of improvement of  
strength and durability properties. Polymer concrete, and  
concrete bound with polymer, appears to be a promising  
material for cast-in-place applications. This report briefly  
summarizes material and applications development in  
concrete-polymer materials throughout the

### Nonmetallic Coatings for Concrete Reinforcing Bars. Coating Materials

National Bureau of Standards, Center for Building Technology. James R. Clifton, Hugh F. Beeghly, and Robert  
G. Mathey. April 1973. 40 pages.

COM-73-50379

Premature deterioration of reinforced concrete is a matter  
of concern in saline environments. The chloride ion is  
ultimately responsible. Although steel is passive to corrosion  
in the environment of high basicity inherent in  
portland cement, chloride ions depassivate it and thereby  
promote active corrosion. When reinforcing bars corrode,  
spalling and cracking of the concrete result, necessitating  
extensive and expensive repairs. The report deals with  
determining the feasibility of using organic coatings,  
especially epoxies, to protect steel reinforcing bars  
embedded in concrete from the accelerated corrosion  
attributable to the chloride ions. Several coatings were  
evaluated on the basis of their chemical and physical  
durabilities as well as their protective qualities. Attention  
is directed to application methods, surface preparation  
of bars, and sites of application. A tabulation is  
presented of the materials studied, with some comments  
on their qualities.

### Retarders for Concrete, and Their Effects on Setting Time and Shrinkage

Purdue University, Joint Highway Research Project. Yasuhiko  
Yamamoto. December 1972. 197 pages.

PB-220 172

Chemicals that retard the setting time of concrete serve  
to alleviate problems associated with hot weather concreting,  
mass concrete, multilift concreting, and continuous  
placement. In addition, many retarders reduce the  
water requirements to produce a concrete of desired  
workability and produce a concrete of higher strength  
with equal cement content. Some retarders also produce  
effects similar to those produced by air-entraining additives.  
This document describes the results of a study that  
was undertaken to gain some insight into effective molecular  
structure of retarders and to examine the shrinkage  
behavior of cement pastes as affected by the addition  
of retarders. A total of 65 organic chemicals and three  
commercial retarders were tested and compared. It was  
found that hydroxyl, carbonyl, and carboxyl groups are  
all effective in retarder molecules. Strong retarder molecules  
contain many of these groups in such a way that the  
oxygen atoms are constrained to approach each other  
closely. Retarders tend to cause a moderate increase in  
the shrinkage of cement paste, the amount being dependent  
on the content of evaporable water and degree of  
hydration of the paste.



### **An Investigation of Concrete Quality Evaluation Methods**

Texas A and M University, Texas Transportation Institute. Rudell Poehl, Gilbert Swift, and William M. Moore. November 1972. 45 pages.

**PB-223 390**

The report deals with bridge deck deterioration. Four compressive strength techniques applicable to field detection of poor quality areas in concrete bridge decks are described and compared. Comparisons are made between measurements made on concrete cores in the laboratory and on cores taken from actual bridge decks. The techniques are acoustic velocity, Windsor probe (slightly destructive), Schmidt rebound hammer, and direct tensile strength (also slightly destructive). Details are given for each method. Initial tests were conducted on slabs constructed from 12 different batches of concrete containing three different types of aggregate, and varying widely in cement factors. Then measurements were made on slabs taken from actual bridges selected for a variety of ages and concrete strengths. Measurement difficulties are discussed. The results indicate that each technique is usable, but that since all the core strengths obtained appeared to involve different responses to deterioration effects, other methods may be applicable as well.

### **Polymer-Impregnated Concrete for Highway Applications**

University of Texas, Center for Highway Research. David W. Fowler, James T. Houston, and Donald R. Paul. February 1973. 172 pages.

**PB-223 409**

The deterioration of concrete bridge decks in many parts of the world has received much attention from various research groups. It has been established that the most prominent parameters affecting the durability of bridge decks are permeability, volume change characteristics, and wear strength of the hardened concrete. This document describes a polymer-impregnated concrete surface treatment that indicates that better, more maintenance-free bridge decks are possible. The treatment essentially consists of applying a monomer solution (containing methyl-, isobutyl-, or isodecyl-methacrylate plus a catalyst and a cross-linking agent) as a spray and allowing it to polymerize in situ after it soaks into the concrete. The result is a bridge deck of greater durability, moisture tightness, and skid resistance than untreated concrete. Preliminary studies have indicated that this treatment is also potentially useful in the repair of cracked concrete beams and for protecting submerged concrete piles from seawater corrosion.

### **Quality Assurance for Portland Cement Concrete**

New York State Department of Transportation. John DiCocco. September 1973. 167 pages.

**PB-226 585**

Although the concept of quality assurance has been successfully applied in most industrial development, the construction industry is just beginning to recognize its importance. Quality assurance has many definitions; one used here contains the three elements of quality control in production, acceptance sampling or inspection, and establishment of tolerance limits or statistical analysis. These are discussed with respect to portland cement concrete engineering. The report begins with a discussion of uniformity and specifications compared to the current situation which would appear to have shortcomings. Next are producers' techniques to achieve compliance with requirements, including three case studies which indicate favorable results. The discussion on inspection gives attention to schemes in a particular city; alternatives are suggested for fresh and hardened concrete.



## **EARTHQUAKE ENGINEERING**

### **Earthquake Response of Axisymmetric Tower Structures Surrounded by Water**

University of California, Earthquake Engineering Research Center. C-Y. Liaw and Anil K. Chopra. October 1973. 166 pages.

**773 052**

Mathematical formulation for the response of axisymmetric cantilever towers partly submerged in water, such as bridge piers and hydroelectric dam intake towers, to earthquake ground motion is presented, based on linear analysis and on water as an incompressible fluid. Effects of surrounding water on the earthquake response are illustrated as significant. Expressions are presented, including hydrodynamic interactions, for individual modes of vibration to harmonic ground motion. It is noted that water interaction increases the fundamental period of tower vibration and decreases the modal damping. The method involves a substructure approach in which an axisymmetric tower and a surrounding water environment are treated separately. Response to earthquake ground motion is determined by step-by-step integration of the equations of motion. A computer program is described for analyzing the subject system. Several analyses of two reinforced concrete towers in the field are presented. Based on the findings, some aspects of design of towers to withstand earthquakes are discussed.

### **Rate of Loading Effects on Uncracked and Repaired Reinforced Concrete Members**

University of California, Earthquake Engineering Research Center. V. V. Bertero, D. Rea, et al. December 1972. 157 pages.

**PB-224 520**

It has been suggested that buildings should be capable of resisting the most severe earthquake anticipated at a particular building site without collapse, and that structural damage in even a major earthquake should be repairable. To evaluate a proposed building design, the structural response, including displacements and required ductilities, must be determined for various earthquake severities. The ability of the building to sustain these displacements and inelastic deformations without collapse must be evaluated, and the total costs, both initial and for damage repair as well as occupancy loss owing to earthquake action, must be predicted. Such evaluation is difficult in the present limited state of knowledge, especially for reinforced concrete structures. Consideration is given in this report to the effect of high-loading rates on the behavior of reinforced concrete structures and the effectiveness of an epoxy-injection technique of repairing cracks in such structures. Six simply supported doubly reinforced concrete beams were tested by imposing zones of time varying moment at the third points of the beams by electronically controlled hydraulic actuators. Damage in two of the specimens was limited so that they could be repaired by the injection of epoxy resins into cracks and later retested. The results are reported and discussed.

### **Earthquake Engineering Research at Berkeley—1973**

University of California (Berkeley), Earthquake Engineering Research Center. 1973. 235 pages.

**PB-226 033**

This document is comprised of 29 papers dealing with earthquake research, presented at an international conference on earthquake engineering held in 1973 in Rome, Italy. Some of the subjects discussed are: Strong ground motions; earth crust stresses; dam studies; soil and structure interactions during earthquakes; vibration in multistoried buildings; shaking-table dynamics; behavior of concrete beams, frames, and reinforced structures; energy-absorption devices; simulator tests; computer applications; highway-overcrossing response; steel-frame dynamics; design implications of selected buildings; and earthquake disaster preparedness. Mathematical models are presented, and tabular and graphic data are included.

## **ECONOMICS OF DEVELOPMENT**

### **Market Profiles for the Caribbean**

Department of Commerce, Bureau of International Commerce. September 1973. 12 pages.

**COM-73-50182-45**

This document provides a brief summary of economic data for each of 10 Caribbean countries. The countries are: Bahamas, Barbados, Bermuda, Dominican Republic, Guyana, Haiti, Jamaica, Netherlands Antilles, Surinam, and Trinidad and Tobago. Data on the following economic parameters are given where available and applicable: Imports; exports, trade policy, trade prospects, foreign investment, currency, domestic credit, national budget, foreign aid, balance of payments, gross national product, agriculture, industry, tourism, transportation, communications, power, land, climate, minerals, forestry, fisheries, population size and composition, language, education, labor force. This information should be of interest to those interested in doing business in any of these countries.

### **Market Profiles for Mexico, Central America, and Panama**

Department of Commerce, Bureau of International Commerce. October 1973. 8 pages.

**COM-73-50182-47**

This document contains summary economic information on Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama. For each country, the following information is provided where available and applicable: Imports; exports; trade policy; trade outlook; foreign investment; currency; domestic credit and investments; national budget; foreign aid; balance of payments; economic growth; gross national product; agriculture; industry; commerce; tourism; transportation; communications; power; land; climate; minerals; forestry; fisheries; livestock; population size and composition; language; education; labor force. The information should be of interest to those sizing up in a preliminary way market conditions and the investment climate in this area of the world.

### **Market Profiles for the Near East and South Asia**

Department of Commerce, Office of International Marketing. December 1973. 23 pages.

**COM-73-50182-59**

This document presents a summary of the economy of each of 22 countries of the Near East and South Asia

areas. The countries are Afghanistan, Bahrain, Bangladesh, Burma, Cyprus, Egypt, India, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Nepal, Pakistan, Qatar, Saudi Arabia, Sri Lanka, Sultanate of Oman, Syrian Arab Republic, Turkey, and United Arab Emirates. For each country, the following information is provided where applicable and available: Imports; exports; trade policy; trade prospects; foreign investments; currency; domestic credit and investment; foreign aid; national budget; balance of payments; gross national product; agriculture; industry; transportation; communications; power; land; climate; minerals; forestry; commerce; tourism; fisheries; development program; population size and composition; language; labor force. This information should be of interest to those interested in doing business in any of the countries covered.

### **Market Profiles for South America**

Department of Commerce, Bureau of International Commerce. December 1973. 11 pages.

**COM-73-50182-61**

This document is comprised of a series of summaries of the economies of each of 10 South American countries. The countries involved are: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela. In each case, information is provided on imports, exports, trade policy, trade prospects, foreign investment, domestic credit and investment, foreign aid, national budget, balance of payment, gross national product, agriculture, industry, commerce, transportation, communications, power supplies, natural resources, population size, literacy rate, and work force. The document should be of interest to those intending to do business in any of these countries.

### **Market Profiles for the Far East**

Department of Commerce, Bureau of International Commerce. December 1973. 16 pages.

**COM-73-50182-62**

This document is comprised of a series of summaries of the economies of 14 countries in the Far East. The countries involved are: Australia, Cambodia, Hong Kong, Indonesia, Japan, Korea, Laos, Malaysia, New Zealand, Philippines, Singapore, South Viet-Nam, Taiwan, Thailand. In each case, information is provided on imports, exports, trade policy, trade prospects, foreign investment, currency, domestic credit and investment, national budget, balance of payments, economic growth, gross national product, agriculture, industry, commerce, transportation, communications, power supplies, area and character, climate, mineral resources, population size, and work force. The document should be of interest to those intending to do business in any of these countries.



## et Profiles for Africa

ment of Commerce, Bureau of International Com-  
December 1973. 46 pages.

73-50182-75

document contains summaries of the economies of  
can countries. Excluded from consideration are  
which is included in a companion publication) and  
per of the smaller dependent territories. The fol-  
information is given for each country, where  
le and applicable: Imports, exports, trade policy,  
prospects, foreign investment, currency, domestic  
nd investment, national budget, foreign aid, bal-  
payments, gross national product, agriculture,  
y, commerce, tourism, development plan, trans-  
n, communication facilities, electric power, natu-  
resources, population size and composition, education,  
orce. This information should be of interest of  
tending to do business in any of these countries.

## as Business Reports

ment of Commerce, Bureau of International Com-

3-50182-71. Basic Data on the Economy of  
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ed Arab Emirates. April 1973. 16 pages.

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ebruary 1973. 35 pages.

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1973. 12 pages.

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Bangladesh. June 1973. 8 pages.

COM-73-50182-67. Foreign Trade Regulations of  
the Arab Republic of Egypt. December 1973. 7 pages.

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the Republic of Ghana. November 1972. 8 pages.

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Hong Kong. December 1973. 12 pages.

COM-73-50182-66. Foreign Trade Regulations of  
Korea. December 1973. 12 pages.

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the Libyan Arab Republic. April 1973. 8 pages.

COM-73-50182-34. Foreign Trade Regulations of  
Malaysia. July 1973. 8 pages.

COM-72-50175-072. Foreign Trade Regulations of  
Mexico. December 1972. 16 pages.

COM-73-50182-07. Foreign Trade Regulations of  
Morocco. April 1973. 12 pages.

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Peru. June 1973. 11 pages.

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Turkey. December 1973. 8 pages.

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the Republic of Zambia. June 1973. 7 pages.

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Procurement Procedures. December 1973. 16 pages.

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Private Sector. December 1973. 14 pages.

COM-73-50182-64. Selling in Indonesia. December  
1973. 20 pages.

COM-73-50182-41. Selling in Nigeria. September  
1973. 12 pages.

COM-73-50182-42. Selling in Peru. September 1973.  
16 pages.

This series of documents contains basic, authoritative  
information for those who are reviewing their interna-



tional trade position in current markets, or who are considering entering new areas. A current selection of titles is listed below. These documents are revised as significant new information becomes available, and purchasers will receive the most recent revision available at the time of the purchase.

### **Development Strategies in Open Dualistic Economies**

National Planning Association. Douglas S. Paauw. August 1970. 117 pages.

**PB-218 758**

A developing economy may be characterized as dualistic in two different ways. Its agricultural sector may be separated from the industrial sphere, or there may be a technological gulf between its modern sector employing advanced methods and a backward and traditional sector resisting change. The dualism can refer to the entire economy or to a particular segment of it. The report discusses open dualism in four economies of Southeast Asia—Taiwan, Malaysia, the Philippines, and Thailand—relating to international trade as an essential aspect of growth. Among such less developed countries, the openness consists of a high ratio of exports to gross national or domestic product resulting from an external orientation inherited from European colonialism. Transition from colonialism to self-sustained modern growth varies in duration, sequence, and order. A triangular pattern is discussed in which industrialization becomes the key objective in transition growth. Export substitution plays a great part in the process whereas import substitution operates where industrial sector growth substitutes domestic manufactured consumer goods for imports. The analytical framework is appropriate for both theoretical and empirical analysis, as well as for policy formulation.

### **Three Essays on the Economics of Subsidies**

Institute for Defense Analyses, Program Analysis Division. J. A. Stockfish. March 1973. 107 pages.

**PB-219 078**

Government policies that attempt to deal with a decline in the financial condition of an industry frequently involve subsidy payments to the ailing industry. Subsidies have become part of the economic scene, even though clear indications have been made that under certain circumstances their net effect is harmful. The decision to keep an industry going by subsidization often appears to be a political rather than an economic one. In any event, when a decision to subsidize has been made, the analyst must determine which option is best. The report presents an introduction to the complicated subject of subsidies, in three parts. The first is a theory of excise subsidies in which the subsidy is seen as an excise tax in reverse,

with payment to a private party instead of liability imposed. The second deals with in-kind subsidies involving activities serving private ends that are not assessed to cover their production costs; an example is provision of low-cost irrigation water. The third is a discussion of public utilities management, involving the setting of prices and the amount of resources that should be invested in a particular utility. Consideration is given to the concept of marginal cost pricing as opposed to average or full cost pricing. Monopoly pricing is also discussed.

### **Surplus Labor and Economic Development: The Guatemalan Case**

University of Wisconsin, Land Tenure Center. Margaret Gollas. January 1970. 99 pages.

**PB-219 494**

Economic development in the traditional sector of the Guatemalan economy is discussed in this document. An explanation of the theoretical framework for the research is followed by an analysis of Guatemala's labor productivity history. The allocative efficiency of Guatemalan Indian farmers is analyzed on the basis of the data collected from intensive field interviews. The basic need is described for creation of an agricultural surplus that can initiate the process of industrialization. Improvement should be attainable by pushing the agricultural production possibility curve of highland agriculture outwards. A policy of introducing nonconventional inputs and new technologies is suggested, along with policies to increase rural economic resources. Guatemalan farmers are seen as poor and inefficient, so that any increase in efficiency must be accompanied by reallocating resources. Dualism in an underdeveloped country may consist of different production functions in the advanced and traditional sectors, with slow growth of the modern sector in the face of rapid population growth in the traditional sector. A discussion of conditions, implications, and possibilities is presented.

### **The Transition in Open Dualistic Economies, Vol. 1**

National Planning Association, Center for Development Planning. Douglas S. Paauw and John C. H. Feiwel. 1970. 350 pages.

**PB-219 552**

A two-volume report discusses a particular type of developing economy in which two sectors—agriculture and industry—coexist with a technical gap between them and both are strongly affected in growth by foreign trade. The concept of open dualism, which is applied to this condition, is relatively new, although the concept of openness, in the sense of an economy's access to international trade, has long been recognized in economic literature.

as an important aspect for less developed countries. Interrelatedness is identified between agriculture, industry, and foreign trade. The concept of transition growth is explained in terms of these three. Volume one covers transition growth types such as import substitution, export promotion, export substitution, organization for import substitution, and organization for export promotion. The discussion includes a stagnant agriculture, trade gaps, food-deficient import substitution, and development of a realistic economic model relating to food security.

### **Transition in Open Dualistic Economies.**

2

International Planning Association, Center for Development Planning. Douglas S. Paauw and John C. H. Fei. July 1973. 395 pages.

219 553

The second volume of a two-volume report discusses the development of developing countries characterized by dichotomy between their agricultural and industrial sectors, while both sectors are influenced by foreign trade. The beginning section deals with postwar transition in the Philippines, including pure import substitution during 1950-1965 and prolongation of import substitution during 1965-1975. Next is a review of export promotion transition and systems leading to models to investigate long run prospects. The following sections deal with postwar transition in Thailand, Malaysia, and Taiwan. Then the implications for development strategy and policy decisions in the developing nations with especial reference to transition from the colonial epoch to the modern epoch with emergence of new classes of economic agents. Essential guidelines are presented: Selection of a dominant focal view of the economy, necessity for a typological emphasis, and adoption of a transition orientation. It is emphasized that all development policy advice must be based on inductive evidence, particularly statistical

### **Determination of Individual Hourly Earnings in Urban Kenya**

University of Michigan, Center for Research on Economic Development. George E. Johnson. May 1972. 37 pages.

225 805

A consensus is emerging among economists that the real level of wages in the modern sector of a less developed country may be too high to permit the efficient allocation of resources. The high wages promote rural to urban migration in spite of employment difficulties, resulting in urban-rural imbalance. Rapid increase of modern sector real wages can lower the rate of employment relative to output. The combination of factors tends to lower the rate of economic growth. The report investigates the factors that account for differ-

ences among individuals in hourly earnings in the major urban center of one of these nations, Kenya. The economic analysis includes nonpecuniary attributes of a given job, the type of employment, labor market discrimination against certain subgroups such as females or ethnic groups in the society, and personal productivity of the individual. The effect of trade unions is considered, along with the large fraction of wage earners who are employed by the national government. If the government enforces a code of minimum wage levels, too many people will move to urban areas. The discussion notes the effect of education on potential earnings, the influence of age, the lower earnings rate of females, and makes a survey of the largest tribe in Kenya, which is observed to receive lower wages than any of the three other major tribes.

### **An Intergenerational Model of Population Growth**

University of Minnesota, Center for Economic Research. Assaf Razin and Uri Ben-Zion. July 1973. 24 pages.

PB-225 930

The report begins with the observation that the problem of population growth has not yet been formulated in an intertemporal context, so that a link between population theory and economic growth theory is lacking. A move toward providing such a link consists of developing a model of optimum population growth, considering the quality of life of a new population and the utility of the several generations composing it. A simple case is set up for a developing people involving identical individuals, the number of people in each generation, the total amount of physical capital and the capital per individual, and the additive utility function for each generation assuming identical preferences. It is assumed that for any generation the amount of capital inherited from previous generations can be allocated to three ends: consumption, population increase, and the amount of resources to be passed over to the next generation. Equations are derived and discussed in a technical and mathematical treatment. Some constraints are included also.

### **Economic Factors Affecting Population Growth: A Preliminary Survey of Economic Analysis of Fertility**

University of Minnesota, Center for Economic Research. T. Paul Schultz. April 1973. 30 pages.

PB-225 931

Since the Malthusian theory which relates human population to resources and death rates, is no longer so generally accepted, there is now no satisfactory explanation of all factors affecting population growth. Recently, however, some progress has been made in explaining differences in fertility within a economic framework. Of



particular note have been variations in the relative monetary cost of raising children vs. the value of time parents devote to child raising. The report reviews some statistical analyses of fertility and the educational levels of men and women, the earnings where husbands and wives are working, child mortality, and birth control. In general the author views fertility as responding to both time and resource constraints. He outlines several unresolved problems in the field and speculates on how economic inquiry might be productive of more answers. Attention is called to a frequent inverse relation between income and fertility in many regions.

### **An Alternative Approach to the Theory of Labor Supply in LDCs**

University of Minnesota, Department of Agricultural and Applied Economics. Egbert Gerken. July 1973. 43 pages.

**PB-225 932**

The transformation from an agricultural to an industrial economy is seen as the central part of the evolution of a developing nation. The principal bond between sectors appears to be the labor market, although little attention has been given to labor markets as compared to other markets. The report concentrates on the supply side of labor markets, discussing the assumptions, classical and neoclassical, in terms of the income versus leisure framework. The underlying behavioral assumptions are considered in sociological terms. A model of economic behavior in the peasant family-farm-household is presented. The model is then extended and applied to account for purchased inputs in both farm and household production, social conditions of work, and for family labor leaving the agricultural sector.

### **Annual Budgeting and Development Planning**

National Planning Association, Center for Development Planning. William I. Abraham. December 1965. 45 pages.

**PB-225 945**

A critical need for coordination between development planning and government budgeting is being increasingly recognized. Some trends discussed in current literature are examined in this report and several points for further research are suggested. A main emphasis is that development programs in less developed countries may do well to devote more attention to turning plans into budgetary action. Several topics considered are controlling government spending, managing public enterprises, coordinating local and central government budgets, analyzing tax measures, and seeking new sources of tax revenue as well as forecasting financial resources.

### **Technical Change and Population Growth in the Economic Development of Japan**

University of Minnesota, Economic Development Center. Mitoshi Yamaguchi. July 1973. 247 pages.

**PB-225 952**

Although population growth has been intensely investigated in recent years, the relationships among technical change, population growth, and economic development are still poorly understood. Most of the studies in this area have only used partial equilibrium models. In this report, an effort is made to construct a general equilibrium growth model that should allow a simultaneous consideration of technical change in agriculture and nonagriculture, and of population growth on economic development. The model is called a compound two sector model. In an effort to bridge the gap between abstract growth theory and history, empirical values for the model are estimated for Japan and the US for a decade between 1880 and 1970. This allows a comparison of the structure of these economies and the structural changes that occurred in each of them. Then the model is used to measure the historical contribution of technical change, population and labor growth to economic development in Japan. Simulations are performed with different assumptions about the rates of technical change and of population growth. These simulations give insight into policy options of less developed countries that may have an economic structure similar to the one of Japan in the past.

### **The Supply of Money and Bank Credit in Argentina**

University of Minnesota, Economic Development Center. Edgardo Barandiaran. January 1973. 38 pages.

**PB-225 955**

The report analyzes the process determining the supply of money and bank credit in Argentina since the banking reorganization of 1957. Two definitions of money are used, the traditional one including a bank's demand deposits plus currency held by the nonbanking private sector, and a broader definition that adds banks' savings and time deposits. The outstanding amount of ordinary bank loans to the public is used as the empirical counterpart of bank credit. The Argentine banking system is government operation under direct control of the executive branch. It supplies high-powered money to the economy through the purchase and sale of foreign money and gold, accepts Federal government debts, and advances and rediscounts to commercial banks. It is assumed that any undesirable effect that the foreign supply might have on money supply can be offset by the Central Bank within the time unit of analysis. An econometric model is developed that includes a total demand equation, a total supply equation, and the equilibrium condition between demand and supply. The nominal interest rate is set at zero. A detailed analysis is made of the mathematical structure of the model.



**The Natural Resource Potential for Regional Development of Limon Province: A Preliminary Survey**

Cornell University, Program on Policies for Science and Technology in Developing Nations. October 1973. 162 pages.

PB-226 621

The study described in this report is part of a larger effort to understand the role of science and technology in the development of a small country such as Costa Rica. It was a multidisciplinary team, the major portion of which was comprised of residents of Costa Rica and Costa Ricans studying in the US, to perform a broad survey of the natural resources existing in Limon Province, Costa Rica. The multidisciplinary approach used in the study may be unique in that scientists and engineers participated with economists and regional development planners from the beginning. Limon Province has been neglected for years and consequently its resources had not been fully explored. This report, in describing the results of the study, covers the following topics: History of the province; population; human resources in the urban sector and in the rural sector; agricultural crops; livestock; forests and forestland development; fish resources; minerals and energy; ministries and autonomous institutions involved in regional development; transportation; Limon-Cieneguita Port; industrial development; tourism.

**Research on Employment in the Rural Nonfarm Sector in Africa**

Michigan State University, Department of Economics. Carl Liedholm. April 1973. 41 pages.

PB-228 251

The objectives of the paper are to summarize the existing knowledge of the rural nonfarm sector in the developing countries of Africa, and to develop an analytical framework for examining the use of labor in this nonfarm sector. Considerable importance may be ascribed to this exercise. African governments generally are increasingly recognizing the need for producing appropriate strategies and policies for generating rural employment. The strategies often include efforts to expand employment opportunities in nonfarm rural activities. Both the indirect effects of agricultural development policies on the rural nonfarm sector, as well as the effects of policies in such fields as credit and manpower training, must be considered. The analytical framework and the empirical data for developing effective strategies remain to be found. The report discusses the descriptive profile of the rural nonfarm sector, a theoretical model of that sector, and an approach to research in a particular nation, Sierra Leone, with regard to rural nonfarm employment.

**A Study of Small Industries in Gujarat State, India**

Cornell University, Department of Agricultural Economics. Jan H. van der Veen. May 1973. 80 pages.

PB-228 288

There is a pronounced revival of interest in small industries in India, stemming largely from changed conditions following the "green revolution." Since independence the Indian government has aimed to increase participation of the people in the political, social, and economic processes of modernization, particularly emphasizing the importance of the small industries subsector. Since the green revolution has released many food or wages goods constraints to rapid economic growth, there is now opportunity to reverse the capital intensive, low employment policies of the past. The paper presents a descriptive analysis of small industrial units in one Indian state, Gujarat. It explores briefly the industrial setting and outlines the field survey approach for Gujarat State. The commercial orientation of small industrial units and their owners is discussed. The economic interdependence of these units is put into a statewide input-output table. Some of the policy implications for the future are made.

**Meeting the Challenge of Industrialization: A Feasibility Study for an International Industrialization Institute**

National Academy of Sciences, Board on Science and Technology for International Development. August 1973. 145 pages.

PB-228 348

A study has been undertaken to determine the need and demand for, and the organizational structure and possible program of, an international industrialization institute. To this end, a Special International Panel was convened in April 1972. The first part of this report sets forth the Panel's principal findings and recommendations. Consideration is given to a definition of the overall concept of the institute; the interdependence and urgency of world industrialization; defining the need of the institute; recommended objective and character of the institute; an initial program focus; and recommended founding procedure, structure, institutional relations, and endowment funding. The rationale and design of the institute are discussed in much greater detail in the following sections. Finally, a list of references to the literature on international industrialization is provided.

## EDUCATION

### **A History of Agricultural Universities: Educational, Research, and Extension Concepts for Indian Agriculture**

Committee on Institutional Cooperation. K. C. Naik. 1968. 248 pages.

PB-228 246

An analysis is made of the development of agricultural, educational, and research institutions in India, primarily since independence. In some detail the way is described in which US government, universities, and foundations have collaborated with Indian organizations to achieve much progress. Also attention is directed toward what remains to be done. A few of the topics discussed are the modernization of Indian education, famine history, extension and research, community development, support to changing situations, current problems, university-state department relations, farm and resources development, officials' attitudes, principles of possible relevance to developing countries, and statutes. Some trends are noted also.

### **Selected Bibliography and Abstracts of Educational Materials in Pakistan. Vol. 6 No. 3, 1972**

Office of Education; and National Science Foundation. Geti Saad. September 1972. 61 pages.

TT-72-53188/3

This publication contains English-language abstracts of materials published in Pakistan pertaining to education in that country. The materials abstracted were originally published during the period July-September 1972. The topics covered are: Adult education; childhood education;

development of education; education goals; educational planning; education reforms; examinations; higher education; history of education; Islamic education; library literature for children; literacy; medical education; professional education; psychology; science education; sociology; and students' problems; teachers; teaching methods and media; technical education; textbooks; women's education. A special section of abstracts on nationalization of education is also included. (For previous publications in this series see AMTID, May 1974, pages 102.)

### **Selected Bibliography of Educational Materials—Algeria, Libya, Morocco, and Tunisia. Vol. 6, No. 1**

US Office of Education; US National Science Foundation and Agence Tunisienne de Public-Relations. Azzou, Azzou, Christiane Djemili, and Margaret Duggan. September 1972. 40 pages.

TT-72-55145/01

Factors bearing upon educational philosophy in Maghreb countries include the need to combat illiteracy; the need to prepare an often isolated youth to meet the needs and face the requirements of modern society; the need to adapt to a multilingual situation. These factors are strongly reflected in the literature concerning education in the popular, government, and professional press of the Maghreb. This publication provides a collection of English-language abstracts of this literature. The original articles were published during the period January-March 1972. The topics covered include: philosophy and theory of education; educational organization; adult education; teacher training; religious education; artistic education; cooperation; special education; teaching aids; and "Arabization" through education.



## ENERGY SOURCES

### man and Attractive Urban Power Systems

mmman Aerospace Corp. James T. Yen, August 1972. 74 pages.

—760 202

report examines various difficulties facing the power industry at the present time regarding community and environmental relations. Of particular concern are plant siting and disposal of plant wastes. It is proposed that the problems can be resolved by integrating new types of fuel plants and new locations of plants that do not produce serious air and thermal pollution into the community. The goal is achievement of total energy gas turbine power plants to be located underground. Integration is to be obtained with community centers equipped with year-round recreation and job-training facilities. Plans are furnished which show how these new requirements can be met, provided the systems are designed for local needs. It is stated that most of the components involved are already available, although the production of cheap fuels from sources including solid and liquid wastes must be sought. Technical and financial considerations are presented. Elimination of smoke, noise, and air pollution are prime requirements.

### radeep Drilling for Geothermals

ra Tech Inc. Samuel O. Patterson, Bruno E. Sables, and Anthony Kooharian. December 1973. 139 pages.

—774 108

thermal energy is promising as a source of clean, readily available power, available in three stages of potential utilization. The first is from surface manifestations; the next involves resources where abnormal thermal gradients exist; and the third will operate from the natural thermal gradients of about 16 F per thousand feet occurring practically everywhere on Earth. The report is concerned principally with the third stage potential. There is generally little scientific understanding of the nature and behavior of rock at the temperatures and pressures of the great depths; to gain knowledge, a practical means of drilling wells is sought for hot geological settings to the depths of interest. Rotary drilling technology has been proven effective for depths of 10,000 feet leading to reservoir temperatures of 500–600 F and is seen as feasible for further descent. An assessment has indicated that geothermal energy produced from wells in the 35,000–40,000 foot range would provide a self-contained or independent energy source, no need for special problem maintenance systems, and the promise of economic competitiveness up to 100 megawatts.

## Electrical Load Forecasting: A Review

Battelle Memorial Institute, Pacific Northwest Laboratories. W. A. Reardon. November 1972. 74 pages.

BNWL—1694

All capacity planning by electric utilities must begin with a forecast of demand for electric energy. The perceived need then forms the basis of system planning. This document examines the various methods of load forecasting used by electrical utilities. Some of the subjects covered are: Load characteristics; the need for load forecast methodology; the need for accuracy in forecasting; the approach to forecasting; supplementary groupings; load class patterns; data requirements; forecasting methods; reserve margins. A selected bibliography of representative works on this subject is included.

## Energy and Water: Precursors to Development

Oak Ridge National Laboratory. John W. Michel. November 1972. 14 pages.

CONF—721131—1

An abundant supply of low-cost energy has long been recognized as an essential ingredient for the development of a modern economy and one that is a prerequisite to human advancement. Although often unrecognized, the same is true for good quality water used both for agriculture and to meet urban and industrial needs. The basic concept of nuclear energy centers or agroindustrial complexes offers the possibility of providing both of these commodities, especially in areas where little fresh water—but sufficient quantities of saline water—is available. The primary technical uncertainties in this concept relate to the large-scale production of desalinated water and its use, particularly in agriculture. There are also uncertainties related to some of the proposed schemes for making use of nuclear heat and steam in industrial operations. This report discusses some of the work being undertaken in the US to elucidate these uncertainties.

## Energy Research and Development: A Selected Reading List

Oak Ridge National Laboratory, Environmental Information System Office. M. P. Guthrie, E. E. Huber, and G. A. Norwood. November 1973. 217 pages.

ORNL—EIS—73—65 (Rev. 1)

This document contains a selected list of readings designed to aid policy-makers in the identification of promising areas for energy research and development. It is also designed to assist the nonspecialist who wishes to orient himself in this field. The basic aim in compiling the bibliography was to include monographs and reports on technology assessment for each of the many energy



technologies. Emphasis is given to general publications on energy sources, electric power generation, energy uses, and energy supply and demand studies. Subject and author indexes are included for the more than 1000 references that comprises this reading list.

### **Symposium on Energy, Resources, and the Environment**

Mitre Corp. November 1972

**PB-219 952—Set** All four volumes may be purchased together at a somewhat lower total price.

**PB-219 953** Vol. 1. Introductory and Context Sessions. 280 pages.

**PB-219 954** Vol. 2. Panel Sessions on Energy and Resource Issues. 502 pages.

**PB-219 955** Vol. 3. Panel Sessions on Environmental, Economical and Institutional Issues. 462 pages.

**PB-219 956** Vol. 4. Recapitulation of Energy, Resource, Environmental Economic, and Institutional Issues. 223 pages.

These volumes provide a transcript of an international symposium held in Kyoto, Japan, during July 1972. Volume 1 covers the first two sessions. Included are the texts of the keynote address, "Alternative World Futures," and papers on the following topics: Review of the Mitre Corp. study on energy, resources, and the environment; long-range prospects for mankind; international economic implications of the nuclear fuel cycle; Japanese energy perspective; US short- and medium-term issues; Pacific Basin development and future; international energy, resources, and environment context and its evolution. Volume 2 contains transcripts on working sessions on energy issues and the resource issues. Included are feature presentations on the following topics: Development of fusion in Japan and its prospects; technical-economic evaluation of a process using nuclear energy for large steelmaking; present status and future prospects of energy use in the iron industry; magneto-hydrodynamic power generation status and prospects for electric utility application; large-scale use of solar energy; geothermal energy; resource development as a function of Japanese economic growth; Australian energy resources; Indonesian energy resources; some energy and environmental considerations relating to US transportation; urban transportation; uranium enrichment with a sea-thermal power plant. Volume 3 contains transcripts of workshop sessions on environmental issues and on institutional and economic issues. The following feature presentations are included: Environmental action around the world; climate change and the influence of man's activities on the global environment; approaches to Canadian environmental problems; assessment of the industrial ecosystem and industrial policy in Japan; some problems arising out of the low sulfur fuel supply system in Japan; issues involved in the use of coal; environmentally ac-

ceptable fuels by today's technology, with emphasis on gasification; comments on US energy institutions; technology assessment of mass energy consumption; Japanese policy on natural resources development; Indonesia institutional and economic issues; the state of mineral resources. Volume 4 is comprised of reports by the workshop chairman summarizing the issues discussed in volumes 2 and 3.

### **Proceedings of the Solar Heating and Cooling for Buildings Workshop. Part 1: Technical Sessions**

University of Maryland, Department of Mechanical Engineering. Redfield Allen (Ed.) July 1973. 231 pages.

**PB-223 536**

This document contains 36 papers presented at a workshop held during March 1973 that was convened for recognition of a need for the exchange of information on the rapidly expanding field of solar heating and cooling of buildings. The topics covered include the following: Performance of flat plate solar collectors; solar collector of the University of Delaware Solar House Project; materials technology for flat plate steam generator; pressed-film floating-deck solar collector; concentrated solar energy system employing a stationary spherical mirror and movable collector; design considerations for flat plate collectors; survey of solar collectors; solar heaters; energy storage media; flywheel energy storage; suspension medium for heat storage materials gas complemented solar water heating systems; Australian solar water heaters; thermodynamic simulation of a building environmental control system; energy use in a residential community; some sources of information on solar energy; solar radiation data; calculation of building thermal response; an energy conservation demonstration building; an experimental solar air conditioning system; solar powered heating/cooling system with the air conditioning unit driven by an organic Rankine cycle; optimization studies of solar powered absorption air conditioning systems; solar cooling design and cost study; solar heating with solar energy at a facility in France; solar energy development in the USSR; solar water heating in Japan; modeling of solar heating and air conditioning; solar/thermal technologies and technical innovations in the US construction industry; solar community; solar demonstration residence; evaluation of proved natural radiation flux heating and cooling; the drum wall solar heating and cooling system; research and demonstration projects. Part 2 of these proceedings, which is intended to contain transcripts of various discussions conducted during the workshop, is not currently available.

### **Model for the Determination of Optimal Electric Generating System Expansion Patterns**

Massachusetts Institute of Technology, Energy Laboratory. Dennis L. Farrar and Frederick Wooruff, Jr. February 1973. 209 pages.

223 995

Extensive research is currently under way to develop advanced techniques and computer programs in connection with long range electric power generating systems. This multifaceted problem results from the interaction of various interests, particularly the conflicts between public and industrial demands for more electric power, social anxiety regarding environmental protection, and increasing national concern about resource conservation. Systems analysis methods are being applied to these problems. The report documents the initial formulation of a framework or model within which economic, environmental, and security aspects can be evaluated. This Expansion Model consists of three integrated models, designed to be used serially and in iterative fashion to determine the least dollar cost generation expansion plans for regional electric systems. Input and output include decision variables and alternatives along with demand and constraints. The computer codes are directed toward optimizational strategies and minimization of costs.

### **Engineering for the Resolution of the Energy-Environment Dilemma**

National Academy of Engineering, Committee on Power Plant Siting. January 1973. 348 pages.

224 508

This document is based on a study undertaken to provide a rational basis for decisionmaking in dealing with the complex problems associated with choosing sites for electric power generating plants. It focuses primarily on approaches that might become useful during the next 20 years. A procedure is proposed for mitigating power plant siting conflicts that, if implemented, could become effective within the relatively near future research and development projects are identified that, if pursued, might contribute to minimizing siting conflicts to a substantial degree within a decade or so. Finally, considerable information relevant to the energy-environment crisis is included in the reports of the working groups. These reports fall within the following broad subject categories: engineering considerations pertaining to power plant siting and air quality; aquatic environmental zones and siting considerations; radiological engineering aspects of power plants and their fuel cycles; aesthetics and land use systems approach to site selection; energy and economic growth. (Note: Paper copy available only from: Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20540; price \$10.50. Microfiche copy is available from the same source.)

### **Proceedings of the Twenty-ninth Annual Appalachian Gas Measurement Short Course (1969)**

West Virginia University. R. E. Hanna Jr. (Ed.) February 1970. 432 pages.

PB-226 623

Sixty papers are presented on various aspects of measurement technology and equipment use in the fuel-gas industry. The principal focus is on equipment for measuring gas quantities and for pressure measurement and control. Specific topics of discussion are: Basic electronics and gas laws; the fundamentals of metering and regulation; meter testing and repair; large capacity displacement meters; details on turbine, integrating, diaphragm, rotoseal, roots, swirl, orifice, and bellows meters; instrumentation for billing, controlling, and quality assurance; the planning and design of facilities, plants, and pipelines; regulators, with attention to valve noise, inspection procedures, and overpressure protection; telemetering, data handling, and automation; and supervision of operations and personnel. (For other reports in this series see AMTID, May 1974, pages 49 and 50.)

### **The State-of-the-Art of Saltwater Cooling Towers for Steam Electric Generating Plants**

Westinghouse Electric Corp., Environmental Systems Department. A. Roffman, et al. February 1973. 426 pages.

WASH-1244

Electrical power generating plants using steam, whether by fossil fuel combustion or nuclear fission, ordinarily release a significant amount of heat to the environment. When the thermal energy in the steam has provided mechanical energy to the generator turbine, the remains of the steam may be converted back into water by means of a cooling tower. Present condensing systems use fresh water from such natural streams as rivers or lakes, in conjunction with other features such as artificial ponds or streams. The heated water produced may have some undesirable effects on the regional ecology. If saltwater from the ocean or saline streams could be used, undoubtedly benefits would accrue, since fresh water sources are decreasingly available and it is desired to locate some plants in coastal areas. At present saltwater cooling towers are few, and the adverse effects on the regional biota, fresh water bodies, and soil are difficult to ascertain. A state-of-the-art review has been conducted in an effort to answer some of the questions. The report discusses saltwater corrosion fouling control and blowdown, available saltwater cooling tower experience, meteorological measurement techniques and predictions, possible effects of cooling tower salt drift on soil, groundwater, and freshwater bodies, and the effects of atmospheric salt drift on nearby metal structures, power lines, and buildings.



## ENVIRONMENTAL TECHNOLOGY

### An Annotated Bibliography of Selected Sources on the Climate of India 1940-71

National Oceanic and Atmospheric Administration. Annie E. Grimes. October 1973. 156 pages.

COM-74-10166

The bibliography contains 300 references and abstracts of publications, issued between 1940 and 1971, on the climate of India, Pakistan, Bangladesh, nearby land areas, and the oceanic areas surrounding the subcontinent. Subject and author indexes are included.

### Freshwater Biology and Pollution Ecology

Environmental Protection Agency, Water Programs Operations. Ralph M. Sinclair. April 1973. 546 pages.

PB-224 201

The first section of this manual is intended as an introduction to aquatic biology for sanitary engineers, scientists, and others who are involved in freshwater pollution studies, surveillance, or control. Biologists new to the field of aquatic biology and pollution problems may also find it useful for orientation. The second section is directed toward aquatic biologists or persons with comparable experience who are concerned with or are involved in the application of biological principles, techniques, and parameters to pollution studies and abatement programs. The topics covered include the following: Introduction to the classification of the biota; descriptive biology and ecology of aquatic plants; descriptive biology and ecology of aquatic animals; bacteria and fungi as biological reducers and as indicators of water pollution; water quality as it affects aquatic life; some current pollution problems; biological methods and techniques in the evaluation of pollution problems.

### Proceedings, Coal Combustion Seminar, June 19-20, 1973

National Environmental Research Center. September 1973. 318 pages.

PB-224 210

The proceedings contain 10 presentations made during a seminar on research and development regarding the control of air pollutant emissions from the combustion of pulverized coal. Fundamental research was reported on the mechanism and chemistry of fuel nitrogen conversion to nitrogen oxides, analytical scaling of flowfield and nitric oxide in combustors, the relationship of burner design to the control of NO<sub>x</sub> emissions through combustion modification, and NO<sub>x</sub> reduction techniques in pul-

verized coal combustion. Pilot and full scale tests reported on the effect of design and operation variables on NO<sub>x</sub> formation in coal fired furnaces, preliminary evaluation of combustion modifications for control of pollutant emissions from multiburner coal-fired combustion systems, NO<sub>x</sub> emission control for coal-fired utility boilers, a field test program to study methods for reducing NO<sub>x</sub> formation in tangentially coal fired steam generating units, and control of NO<sub>x</sub> formation in wall-fired utility boilers. A program is described which is designed to consider several current fossil fuels, including natural gas, propane, distillate oil, residual oil, and bituminous coal.

### Air Pollution Control in the Primary Aluminum Industry

PB-224 282 Vol. 1. 324 pages.

PB-224 283 Vol. 2. 246 pages.

The results of a study embracing technical and economic aspects of the emission and control of air pollutants from the primary aluminum smelting industry are given in this report. It includes both a survey of the state-of-the-art and a systems analysis of measures to improve pollution abatement. The first volume covers: The nature of the primary aluminum industry; technology of aluminum production; sources and characteristics of effluent releases; technology of emission control; emission monitoring and analytical techniques; reported industry activities and costs; systems analysis of pollution abatement; analysis of control and improvement; potential research and development fields. Volume 2 is comprised of a series of appendices in support of the textual material of volume 1.

### Environmental Quality and Social Behavior: Strategies for Research

National Academy of Sciences, Division of Behavioral Sciences. May 1973. 96 pages.

PB-224 428

The report outlines a rationale for intensified environmental research using the methods of behavioral science and noting approaches for obtaining results. Strategies for obtaining an understanding of environmental problems are considered; and effective and socially acceptable means for dealing with these problems are discussed. Data collection is dealt with, along with the development of environmental information systems. A few of the topics included are human habitat ecology, economic factors, actors and competitors in using resources, institutional changes, policy and program data, criteria for environmental quality, problems of measurement, difficulties in identifying environmental change effects, government policies, public relations, research resources and organizations, and modeling.



## **Effects of Sulfur Oxides in the Atmosphere on Vegetation**

Environmental Protection Agency, National Environmental Research Center. September 1973. 54 pages.

-226 314

Sulfur oxides represent one category of pollutants that affect plant life. Within this category of pollutants, sulfur dioxide (SO<sub>2</sub>) appears to be the major causal agent for plant injury, although plants may respond to other compounds of sulfur such as sulfuric acid aerosols. This document summarizes current scientific knowledge on the subject of the air pollution effects by sulfur oxides on vegetation. The topics covered include: Symptoms of the effects of sulfur dioxide on vegetation; mechanism of action; factors affecting response of vegetation to sulfur dioxide, including environmental factors, genetic factors, stage of plant development; problems in diagnosis and assessment of the economic impact of sulfur dioxide; effects on lower organisms; acid precipitation; vegetation as a sulfur dioxide sink; effects of sulfuric acid mist on vegetation; effects of sulfur oxides on biomass and yield; injury relationships of the sulfur dioxide to vegetation-response.

## **Application of Remote Sensing to Air Pollution Detection and Measurement**

Bureau of Mines, Pittsburgh Energy Research Center. B. Jarney, D. H. McCreary, and A. J. Forney. 1973. 24 pages.

-226 794

The term "remote sensing" denotes the accumulation of information about a subject while located some distance from the subject. Remote sensing techniques, used for many years by earth scientists, are now being applied to the detection and monitoring of air pollution. Many individuals and organizations are involved in research and development to produce instrumentation suitable for this purpose. Numerous systems, both ground-based and satellite, are being tested and are already being applied to air pollution measurements. This document reviews a number of the instruments developed or being developed for air pollution detection and/or monitoring. They include spectroscopic systems such as those involving correlation spectrometry, interferometric spectrometry, and correlation interferometry; laser systems employing Raman scattering, Mie scattering, and laser line absorption; and photographic techniques such as multispectral photography, optical scanning, and satellite borne photographic systems.

## **World Desertification: Cause and Effect. A Literature Review and Annotated Bibliography**

University of Arizona, Office of Arid Lands Studies. Wade C. Sherbrooke and Patricia Paylore. 1973. 172 pages.

PB-228 100

Desert formation about the world appears to be spreading instead of diminishing. Its present visibility appears in belated acknowledgment of the critical consequences of misuse and overuse of earth's natural resources. Actually arid lands development projects may be contributing to water depletion and thereby more desertification. This review and annotated bibliography documents the extent, location, causes, and efforts to reverse the trend. It is aimed at a better understanding upon which any solutions must be based. A discussion is made of two principal causes: long-term climatic changes; and man's activities in dry regions that have contributed to degradation of marginal lands—such as agricultural and irrigational practices, grazing, and fires. A third category of short term or climatic fluctuations is called to attention as well. It is noted that training, education, financing, and cultural modifications are needed, probably under international cooperation. More than 250 abstracts of the worldwide literature on the subject are included, along with author and subject indexes.

## **Noise Facts Digest**

Environmental Protection Agency, Office of Noise Abatement and Control. June 1972. 204 pages.

PB-228 345

This digest has been prepared in response to a widely expressed need for more and better information on noise prevention, abatement, and control. It contains general interest articles as well as abstracts selected from the most recent and significant literature, both domestic and foreign. Some of the materials included are research reports on emission; physiological effects; psychological and sociological effects; economic aspects; building acoustics, noise measurement techniques and instruments; considerations involving city, industrial plant, airport, and highway planning; legislation, codes; ordinances; court decisions; enforcement techniques and experiences; government policies; and educational materials and methods. A glossary of important terms is included.

## **Heated Effluents and Effects on Aquatic Life with Emphasis on Fishes: A Bibliography**

Atomic Energy Commission, Technical Information Center. Edward C. Raney, Bruce W. Menzel, and Emily C. Weller. 1973. 654 pages.

TID-3918

This bibliography contains more than 4000 references to the worldwide literature on the effects of heated effluents from electric power plants on aquatic organisms. A permuted-title subject index and an author index are included.

## FISHERIES & AQUACULTURE

### **The Commercial Feasibility of Rearing Pompano, *Trachinotus carolinus*, in Cages**

University of Miami. Theodore Isaac Jogues Smith. January 1973. 80 pages.

COM-73-10771

In recent years much interest and activity has centered around the possibility of commercially rearing the pompano, *Trachinotus carolinus* (Linnaeus). Pompano are tolerant of a wide range of environmental conditions, can be handled with little or no mortality, and readily adjust to man-made confinements. They grow rapidly and reach marketable size within one year. This report provides the results of an assessment of the suitability of cages for raising pompano and the measurement of growth and mortality at stocking densities that would be likely in a commercial operation. The data collected and observations made during this effort provide the basis of a discussion of the problems and future of pompano farming as a potential industry.

### **A New System for the Commercial Harvest of Precious Coral**

University of Hawaii. Richard W. Grigg, Boh Bartko, and Claude Brancart. February 1973. 11 pages.

COM-73-10774

Precious coral has been used for jewelry since prehistoric times, and dredging has always been the principal method of commercially harvesting this material. With one Mediterranean exception, all major known coral beds are below the range of scuba divers, usually between 300 and 1500 feet down. Collecting by dredging with weighted tangle nets is both inefficient and destructive, so with the world supply of precious coral declining in recent years, a means of selectively harvesting the coral is needed. The report describes a new system that uses a small two-man submersible vehicle. A steel-reinforced wire basket is attached to the submersible front. At the front of the basket a notched steel plate is equipped with a rotatable cutting blade that shears the coral at its base. Details of gathering and capacity are given, along with the mechanical and hydraulic operations involved. Launch and recovery of the submersible are accomplished underwater using a stable platform.

### **Organizing and Operating a Fishery Cooperative**

COM-73-10790 Part 1, 5 pages.

COM-73-10791 Part 2, 44 pages.

Oregon State University. Frederick J. Smith. 1973.

A fishery cooperative consists of a group of fishermen acting together for mutual benefit, and joining in services that individuals might not perform or obtain alone. This two-volume report provides information on the structure of such cooperatives. The first part presents an overview of cooperative organization and operation, covers the characteristics of two varieties of partnerships and of incorporated groups, and discusses the plan and policy features involved. The second part discusses the legal instruments and requirements of a fishery cooperative. Information is provided on preparing bylaws and what to include in them and on marketing agreements, their purposes, and parties involved.

### **The Potentially Commercial Species of Octopus and Squid of Florida, the Gulf of Mexico and the Caribbean Area**

University of Miami. Gilbert Voss, Lee Opresko, Ronald Thomas. October 1973. 40 pages.

COM-74-10319

This manual provides fishermen, the general public, fisheries and conservation personnel with an easily accessible guide to the cephalopods of the Gulf of Mexico and Caribbean that are either fished commercially or have the potential for being fished commercially. A taxonomic key is provided that uses only characters visible to the naked eye. For each species, recognition features are described and, where known, information is given on geographic range, depth range, age and size, spawning habits, commercial fishing gear, and mariculture potential.

### **Sanitation of Shellfish Growing Areas**

Public Health Service, Division of Environmental Health Engineering and Food Protection. Leroy S. Houser (Ed.). 1973. 38 pages.

PB-216 486

This manual is intended as a guide for the preparation of sanitation laws or policies for the sanitary control of growing, relaying, and purification of shellfish. The topics covered include: General administrative procedures; bacteriological, toxicological, physical and chemical laboratory procedures; sanitary surveys of growing areas; classification of growing areas; criteria for approval, conditionally approved, restricted, and prohibited areas; closure of areas due to shellfish toxins; preparation of shellfish for marketing; control of harvesting from closed areas; bacteriological criteria for shucked oysters at the wholesale market level.



## **Sanitation of the Harvesting and Processing of Shellfish**

Public Health Service, Division of Environmental Engineering and Food Protection. Eugene T. Jensen (Ed.). 1965. 62 pages.

3-227 629

This manual is intended as a guide for the preparation of shellfish sanitation laws, regulations, and policies with respect to the sanitary control of harvesting and processing of shellfish. It covers sanitary procedures for the harvesting and handling of shellstock, shucking and packing shellfish, packing and shipping shellstock, and packing of shellfish. An appendix provides graphs of the rate of cooling of fresh oysters in various sized containers in crushed ice and under dry refrigeration. A second appendix describes special procedures to be used when the heat shock method of preparing oysters for shucking is employed. The information contained in this manual should be of interest of regulatory organizations and to the shellfish industry.

## **Chemistry and Technology of Pacific Fish**

National Marine Fisheries Service; and National Science Foundation. I. V. Kizeveter. 1973. 312 pages. (Trans-

lated from *Tekhnologiceskaya i khimicheskaya kharakteristika promyslovykh ryb tikhookeanskogo basseina*, Vladivostok, 1971.)

TT-52-50019

Hundreds of commercial or potentially commercial species are available to fisheries in the Pacific Ocean. Often fish processing operations are faced with handling a diversity of raw matter differing substantially in technological characteristics and chemical composition. This document provides a compilation, from the international literature and from data generated in the author's laboratory, on the chemical composition and the physical and the mechanical characteristics of this raw material. The intent is to provide a basis for solving problems connected with the profitability of processing a particular species or species mix, to establish optimal technical and technological norms, and to establish a good assortment of products. The work encompasses many species of the eastern and western sections of the North Pacific, the eastern tropical regions, the Korean Straits, the South China Sea, and the Gulf of Tonkin. Also included are species of the eastern Indian Ocean, the western coast of Australia, the Great Australian Bight, and the coast of New Zealand.

## **Current & Recommended**

**Compilation of Published Information on Elemental Concentrations in Human Organs in Both Normal and Disturbed States. 4. Data Summary Ordered by Specific Health State, Subordered by Atomic Number, Organ and Organ**

University of California, Livermore

Provides information on element and its concentration, method of analysis, geographical source, age, sex, organ, health state, and number of individuals analyzed. 1973. 100 pp. PC \$7.60/MF \$1.45 order UCRL-51013-P4/G

**Proficiency Test Assessment of Clinical Laboratory Capability in the United States: Appendix Volume**  
National Bureau of Standards, Wash., D.C.

Reports on performance standards and tests of clinical laboratories. 1973. 48 pp. PC \$3/MF \$1.45 order COM-193/G

**Financial Planning in Ambulatory Health Programs**  
Boston Consulting Group, Boston, Mass.

Focuses on the financial implications of organizing and maintaining an ambulatory care center. 1973. 244 pp. PC \$5.75/MF \$1.45 order PB-222-501/G

**Medline Reference Manual**

National Library of Medicine, Bethesda, Md.

A comprehensive manual for the operation of a Medline system: modes of access, commands, techniques plus instructions for use of Serline, Cataline, Sdiline, Comfile. 1973. 227 pp. PC \$5.75/MF \$1.45 order PB-222-991/G

**A Proficiency Test Assessment of Clinical Laboratory Capability in the United States: Final Report**  
National Bureau of Standards, Wash., D.C.

Reviews measures of performance from several different types of clinical laboratories and compares the precision of various analytical methods used by them. 1973. 148 pp. PC \$4.50/MF \$1.45 order COM-73-11190/G



## FOOD & NUTRITION

### **An Evaluation of Common Predictors of Consumer Acceptance**

Army Natick Laboratories, Pioneering Research Laboratory. Laurence G. Branch. April 1973. 20 pages.

AD-759 908

The food service industry increasingly uses scientific professionals to research and develop food products that will attract consumers. For better understanding and prediction of consumer attitudes, most organizations request behavioral science assistance. Definitions of the terms consumer preference and consumer acceptance are not uniformly agreed upon. The report considers these as general likes and dislikes for food classes, and reactions to specific items. Three commonly used predictors are a lengthy paper and pencil questionnaire, an abbreviated questionnaire, and acceptance foods rated by an experienced panel in the field situation. This report provides the results of a comparison of the ability of each of these three methods to predict consumer reactions to food items. It was found that each of the methods was inconsistent with the other two in at least some respects. None of them was exceptionally more or less accurate than the others. These results demonstrate the need for further basic research in predicting consumer acceptance in the food service industry.

### **Preparation of Fish Protein Hydrolysates**

Oregon State University. David L. Crawford. July 1973. 55 pages.

COM-74-10173

Fish protein concentrates constitute an important potential source of supplemental protein for both human and animal feeding. In addition, the production of fish protein concentrates offers the possibility of more fully exploiting a fisheries resource through the use of species not otherwise used commercially and of fish-processing byproducts. This document describes an autolytic digesting system capable of liquefying fish and fish byproducts to produce protein supplements in sufficient quantities for feeding-trial studies and other related physical and biochemical parameters. The digestion system may be constructed of equipment commonly available from laboratory equipment supplies. The document also describes the use of the digestion system to prepare protein hydrolysates from various species of fish and fish scrap; and it discusses the general nutritional aspects of various fish protein hydrolysates obtained with the system.

### **Conversion of Organic Solid Wastes into Yeast: An Economic Evaluation**

Ionics, Inc. Floyd H. Meller. 1969. 182 pages.

PB-218 476

An economic evaluation of the conversion of urban and agricultural solid wastes to edible protein is presented. The approach to conversion of the wastes uses a two-stage process of hydrolysis and fermentation. The operation and economics of each stage are examined in detail. Wastepaper and bagasse were selected for specific studies, but this does not imply a limitation of the process to these raw materials. Also, marketing considerations based on the production of protein of the general character of Torula yeast (*Candida utilis*), although a single-cell protein may be actually used in the product. The potential markets for protein supplements in human food and animal feed are considered. Marketing problems and competitive or alternate product approaches are evaluated on a domestic and international basis.

### **Scientific Literature Reviews on Generically Recognized as Safe (GRAS) Food Ingredients**

PB-223 843    **Calcium Sequestrants.** Informatics, Inc. May 1973. 146 pages.

PB-223 844    **Cholic Acid and Derivatives.** Informatics, Inc. April 1973. 110 pages.

PB-223 845    **Choline Salts.** Informatics, Inc. May 1973. 30 pages.

PB-223 846    **Algae.** Informatics, Inc. May 1973. 100 pages.

PB-223 847    **Acotinic Acid.** Informatics, Inc. May 1973. 24 pages.

PB-223 848    **Pulps (Bagasse, Straw Pulp).** Informatics, Inc. May 1973. 15 pages.

PB-223 849    **Iodine and Iodine Salts.** Informatics, Inc. May 1973. 84 pages.

PB-223 850    **Citrates.** Food and Drug Research Laboratories, Inc. April 1973. 105 pages.

PB-223 851    **Calcium Hydroxide and Calcium Hydroxide Salts.** Food and Drug Research Labs., Inc. May 1973. 100 pages.

PB-223 852    **Sorbose.** Informatics, Inc. June 1973. 100 pages.

PB-223 853    **Corn Sugar.** Informatics, Inc. June 1973. 395 pages.

PB-223 854    **Beeswax and Japan Wax.** Frank and Joe Institute Research Laboratories. May 1973. 33 pages.

- 223 855 **Carnauba Wax.** Franklin Institute Research Laboratories. May 1973. 15 pages.
- 223 856 **Sodium Thiosulfate.** Franklin Institute Research Laboratories. June 1973. 67 pages.
- 223 857 **Gelatin.** Informatics, Inc. August 1973. 10 pages.
- 223 858 **Tannic Acid.** Informatics, Inc. July 1973. 10 pages.
- 223 859 **Tallow and Stearic Acid.** Informatics, Inc. July 1973. 79 pages.
- 223 860 **Succinic Acid.** Informatics, Inc. August 1973. 47 pages.
- 223 861 **Inositol.** Informatics, Inc. July 1973. 66 pages.
- 223 862 **Aluminum Compounds.** Tracor-Jitco, Inc. June 1973. 150 pages.
- 223 863 **Butylated Hydroxyanisole.** Food and Drug Research Labs., Inc. June 1973. 70 pages.
- 223 864 **Sorbic Acid and Derivatives.** Food and Drug Research Labs., Inc. June 1973. 95 pages.
- 223 865 **Malic Acid.** Food and Drug Research Labs., Inc. June 1973. 87 pages.
- 223 866 **Ascorbates.** Food and Drug Research Labs., Inc. August 1973. 99 pages.
- 223 867 **Glutamates.** Tracor-Jitco, Inc. September 1973. 578 pages.

Each of the documents in this series provides an extensive review of the literature on a substance or class of substances that are considered safe for use, in proper amounts, as food additives. Included in each case is information concerning the relevant chemical aspects of the substance (including analytical methods); its natural occurrence; its acute, short-term, and long-term toxicity; its biochemical breakdown, absorption, distribution, metabolism, and excretion; effects on enzymes and other chemical parameters; drug interactions; and extent of human exposure. Lengthy bibliographies are provided. Document titles and order numbers are listed below. Other documents in this series are listed in AMTID, January 1974, pages 57—61.)

### **Bioavailability of Iron Sources and Their Utilization in Food Enrichment**

Report of American Societies for Experimental Biology and Life Sciences Research Office. James Waddell. August 1973. 92 pages.

### **PB—224 122**

This document provides a review of the practice of iron enrichment of foods and an assessment of the suitability of the different iron compounds that have been used. Suitability is judged from the standpoint of the bioavailability of the form of iron used and the effects of the iron compounds on the foods to which they were added. A brief review is given of the changing concepts as to the form in which iron is absorbed which were held during the latter part of the 19th century and the first half of the present century. In addition, the different procedures and tests for measuring iron absorption from the intestinal tract are reviewed. Consideration is then given to factors influencing the absorption of iron from the gastrointestinal tract. These include physiological factors, the effect of iron valence, the effect of food on absorption of iron, the absorption of food iron, and species differences in iron absorption. Experience with iron-enriched cereal foods is then discussed in some detail, with attention being given to historical and recent developments and to the evaluation of the bioavailability of iron in this form. Finally, the iron nutrition of infants and children is reviewed.

### **The Use of Chemicals in Food Production, Processing, Storage, and Distribution**

National Academy of Sciences, Committee on Food Protection. 1973. 40 pages.

### **PB—224 437**

As farming patterns change and as each farmer becomes able to feed more people, dramatic shifts in populations from rural to urban areas have occurred. This results in a more complex food distribution system with a concurrent necessity to preserve food longer without loss of freshness, palatability, and nutritional quality. Although the engineering and mechanical aids to this task are clearly evident to most people, the contribution of chemistry and the chemical nature of food is often misunderstood. This report discusses the use of chemicals in food production, processing, storage, and distribution, with emphasis on the technologic rationale and problems associated with their use. A brief discussion of the general chemical nature of foods is followed by a consideration of the characteristics of food additives, with emphasis on when their use is acceptable or unacceptable. Each of the common classes of intentional food additives is briefly described. Some of the chemicals that can occur as incidental additives, such as pesticides, fertilizers, feed adjuvants, drugs, and packaging materials are reviewed. Finally, consideration is given to the evaluation of the safety of food additives, including the risk-benefit relation, chemical and physical properties, biological considerations, and the respective responsibilities of industry and government in assuring safety.



### **Improving the Nutritive Value of Cereal-Based Foods. Report No. 5**

Kansas State University, Food and Feed Grain Institute.  
William J. Hoover. March 1973. 30 pages.

PB-226 385

A report is made of progress in a project intended to improve the nutritional value of cereal-based foods in North Africa and Pakistan by supplementation and process modification without decreasing the food acceptability to the general consuming public in those areas.

## **Required Reading**

### **Evaluation of Practicability of a Radioisotope Thermal Converter for an Artificial Heart Device**

Westinghouse Electric Corp., Pittsburgh, Pa.

Evaluates a thermal converter mechanism by which thermal energy from a radioisotope heat source is converted to energy for pumping blood. 1973. 378 pp. PC \$10.60/MF \$1.45 order WANL-3043-1/G

### **Medical Data Transmission (MEDINAV)**

CBS Labs., Stamford, Conn.

Analyzes the MEDINAV baseline medical considerations. 1973. 83 pp. PC \$3.75/MF \$1.45 order AD-766-840/G

### **Radioisotope Powered Cardiac Pacemaker Program**

Arco Nuclear Co., Leechburg, Pa.

Reports on the performance of 36 radioisotope powered cardiac pacemakers implanted in humans. 1973. 43 pp. PC \$4/MF \$1.45 order ARCO-3057-14/G

### **Blood Oxygenator Testing and Evaluation, Part II. Procedures and Results**

Brown University, Providence, R.I.

Summarizes results of blood-to-gas transfer measurements in artificial lungs with a review of the techniques employed. 1973. 135 pp. PC \$4.50/MF \$1.45 order PB-222-679/G

### **A survey of Analytical Methods for Determination of Controlled Drugs in Body Fluids**

Arthur D. Little, Inc., Cambridge, Mass.

Surveys and evaluates published quantitative methods for determination of certain drugs in mammalian fluids and tissues. 1972. 246 pp. PC \$5.75/MF \$1.45 order PB-222-502/G

Development of protein fortified wheat based bread, chapatis, and couscous using soy flour, chickpea, flour, broadbean flour has been accomplished. Consumer testing of fortified chapatis has been carried out in Pakistan. Soy fortified wheat flour products based on products demonstrated in this project are being used in school lunch and other institutional feeding programs in India, the Philippines, Colombia, and approximately 15 other countries. Soy flour fortification of other cereal based foods such as noodles and cookies has also been accomplished without loss in product acceptability or appreciable increase in cost. (For previous reports in this series see AMTID, April 1973, page 109.)

### **Clinical Laboratory Performance Analysis Using Proficiency Test Statistics**

National Bureau of Standards, Wash., D.C.

Assesses the proficiency testing aspects of the Clinical Laboratory Improvement Act of 1967 for both hospital and volunteer laboratories. 1973. 62 pp. PC \$1.45 order COM-73-11253/G

### **Psychotomimetics**

Army Foreign Science and Technology Center, Charlottesville, Va.

Discusses the main problems connected with the mental and clinical study of psychotomimetics and the logical preparations which induce psychic activity and changes in healthy people. 1973. 170 pp. PC \$1.45 order AD-765-371/G

### **Symposium on Semiconductor Detectors in Medicine in San Francisco, Calif. on March 8-9, 1973**

Technical Information Center (AEC), Oak Ridge

Presents the papers delivered at the symposium, as an abstracted version of the discussions following the presentations. 1973. 508 pp. PC \$13.60/MF \$1.45 order CONF-730321/G

### **Development of a Left Ventricle-to-Aorta Assist Device**

Thermo Electron Corporation, Waltham, Mass.

Reports and evaluates a left ventricular assist device (LVAD) in terms of long and short range physiological effects including pump function in chronic cardiac failure. 1971. 132 pp. PC \$4.50/MF \$1.45 order PB-222-870/G

### **"Normal" Carboxyhemoglobin Levels of Blood in the United States**

Medical College of Wisconsin, Milwaukee, Wis.

Tells results of a survey of venous blood samples from 29,000 adults obtained at chosen blood bank collection sites. 1973. 250 pp. PC \$5.75/MF \$1.45 order PB-222-502/G



# IGHWAY ENGINEERING

## Old Asphalt Concrete Overlay

California Division of Highways, Materials and Research Department. T. Scrimsher, M. H. Johnson, and G. B. Erman. December 1972. 48 pages.

—219 233

Over the years an obvious contributor to air pollution has been hot asphalt mixture plants. Contaminants include combustion products of fuels used to heat and dry aggregates, dust from dry aggregates prior to mixing with asphalt, and emissions from the mixtures during handling and spreading. It was desired to determine by field evaluations whether cold mixed asphalt concrete could reduce pollution and still provide a durable asphalt concrete pavement. A report is made on the first project studied, a one-mile test section of a one-inch cold mixed asphalt concrete overlay. Construction of the experimental section is described and its performance during the first year of service life is discussed.

## Evaluation of Soil Sterilant Herbicides for Roadside

Transportation Institute. Wayne G. McCully and William J. Bowmer. July 1971. 34 pages.

—219 237

Highway maintenance engineers object to unsightly vegetation around guardrails, sign posts, bridge ends and other structures adjacent to the roadway. Quite often, unwanted vegetation is a safety hazard. This report summarizes two years of study on the use of soil sterilant herbicides for roadside use. Comparative data are given for 4 different herbicides used both singly and in various combinations, applied under a variety of conditions against a number of vegetation types. A number of treatments were found to be satisfactory soil sterilants. In general, the greatest efficiency is had with prescriptive treatments based on the type of plants present, site, and other considerations. The most serious problem to be overcome involves the tendency of the herbicide to move downslope from the application area, resulting in bare soils, which is subject to erosion.

## Vertical Loads on Piles

University of Hawaii, Civil Engineering Department. R. Evans and Paul L. Hummel. September 1972. 65

220 287

In some geographic areas highway construction requires the use of piles driven into the subbase, especially where soils are soft, alluvial, and extending to significant depths. The piles are either vertical or inclined. The report covers determination of the allowable lateral load capacity of 16.5 in. octagonal prestressed concrete piles

having a vertical load capacity in excess of 100 tons. It is expected that the adoption of higher allowable vertical and lateral loads would result in saving in the cost of foundations owing to elimination of batter piles or reduction in the number of piles required to carry the loads. It appears that vertical piles and piles loaded against the batter exhibit about the same allowable lateral load capacity, and the piles driven in groups can effectively develop twice the capacity of single piles, provided adequate reinforcement is available to minimize rotation of the butts of the piles.

## Highway and Bridge Maintenance: Operations, Costs, and Modeling

National Academy of Sciences, Highway Research Board. 1973. 67 pages.

PB—224 023

There has been a tendency to overlook maintenance costs when new roads are programmed for construction, but maintenance costs persist long after construction is finished. The problem is serious in all countries but is especially so in the developing nations where money for national transport development is provided by lending agencies that expect the borrowers to continue to maintain facilities with little or no aid. The first of the six papers in this collection addresses the matter of inventorying the road system and estimating maintenance requirements and costs in Sudan. The next discusses a maintenance costing method for low-volume roads, with special reference to Sudan. The third describes simulation modeling of US highway maintenance operations involving roadside mowing in Delaware. Following this is an evaluation of equipment use and management within the State of Virginia department of highways. Fifth is the report on an instrument for detecting delamination, or horizontal cracking, in concrete bridge decks. The last also concerns bridge deck delamination and deterioration.

## A Statistical Summary of the Cause and Cost of Bridge Failures

Federal City College. Fred F. M. Chang. September 1973. 46 pages.

PB—224 091

Millions of dollars are spent each year on the repair and replacement of bridges. To curtail this cost, extensive research is funded yearly on bridge failure. The report presents a few statistical summaries on bridge failure during floods in the hope that a guideline toward further research may be revealed. Data for the bridges selected include dimensions, materials, year built, damage sites, apparent damage cause, and cost involved. Some of the topics discussed are flood size, overtopping flow, critical scour, structural deficiency, riverbed change, flow change, flow path deficiency, and floating debris.

### **Fatigue and Stress Analysis Concepts for Modifying the Rigid Pavement Design System**

University of Texas, Center for Highway Research. Piti Yimprasert and B. Frank McCullough. January 1973. 147 pages.

**PB-226 097**

Traffic associated fatigue of concrete is a significant influence in the distress of a highway pavement system. A mathematical model has been developed for simulating the behavior of rigid pavements in the field under repeated loads. The stress analysis prediction applies to any condition of subbase pumping or erosion for both reinforced and nonreinforced pavements in varying degrees of load transfer. A fatigue equation for portland cement concrete is presented. Laboratory data quantify the parameters of the equation. Load transfer analysis in a road test shows the amount of reduction in bending and twisting stiffness at the joint of reinforced sections or nonreinforced sections. Some other topics of discussion are boundary variables, fatigue in flexure, probability of failure, concrete slab properties, traffic distribution, and the road test equation. Of particular interest is the shape of the eroded area beneath two adjacent slabs, developed to simulate the pumping condition in the field.

### **Testing for Debonding of Asphalt from Aggregates**

University of Arizona, Arizona Transportation and Traffic Institute. R. A. Jimenez. April 1973. 59 pages.

**PB-226 413**

A combination of weather conditions, such as precipitation and temperature, with the stresses of traffic may lead to the loss of cover or surface material in asphalt over aggregate pavements. Development of a new test procedure regarding this degeneration, termed stripping, is reported. The new debonding susceptibility test incorporates the following concepts: Cylindrical specimen size is about 4 in. in diameter and 2.5 in. in height. The specimen is to be saturated, since pore water pressure is included in the tests and it is believed that such pressure develops under field conditions. Exposure of the specimen will be a repeated pore water pressure test at 122 F only. Such a temperature approaches the value observed in southern Arizona to reduce asphalt viscosity and thereby present less resistance to debonding. The strength test is to be simple, repeatable, and of the tension type at 77 F. Effects of exposure on tensile strength is expressed as retained strength determined with a double punch procedure. Laboratory research shows that the method will respond to variations in type of aggregate, aggregate cleanliness, and asphalt content in directions dictated by experience. Comparative results are given for the immersion compression test currently in use.

### **Pavement Systems Analysis**

National Research Council, Highway Research Board. 1973. 194 pages.

**PB-227 156**

This compilation contains 13 research papers that address a number of topics related to the characteristics and performance of highway pavement systems, and are directed to both researchers and engineers. The subjects of discussion are as follows: A prestressed concrete highway pavement at one airport; probability concepts and applications in the design of rigid pavements; structural variables and the performance of continuous pavements; finite element analysis of concrete slabs for rigid pavements, correlation of CBR test results with compaction and soil support values; estimation of the equivalent single axle load for equivalent axle load on certain primary interstate road systems; stiffness history of asphalt concrete surfaces; layer analysis of a test road and its application to pavement design; fracture or ultimate strength analysis of asphalt pavement layers after repeated loading; sensitivity analysis of materials in a fatigue damage model; the principle of superposition; pavement slabs on an elastic foundation; a pavement feedback control system. The various analyses include numerical methods, mathematical modeling, and computer programming.



## **HOUSING & URBAN TECHNOLOGY**

### **Research Study on the Socioeconomic Aspects of Low-Cost Housing in the Philippines**

National Bureau of Standards; and Sycip, Gorres, Velayo and Co. May 1972. 250 pages.

COM-74-10722

An extensive socioeconomic research survey, conducted in the Philippines is described. Directed generally toward low-cost housing characteristics of the archipelago, the report includes such varied information as data on housing and associated damage; comparative climatic and financial indices for housing construction; an economic profile including gross national product and production output indicators; the regional demographic profile for urban and rural areas; sizes and densities of household dwelling units; trends in floor area space; community and municipal facilities; household incomes and expenditures; financing sources for housing construction; construction materials including availability and prices; oil, asphalt, and plastics chemicals; requirements for construction capabilities for the housing industry;

wages and productivity of labor in the construction industry; public reactions to new designs and materials; construction methods; codes for buildings and construction work; and housing projects.

### **Proceedings of the Urban Technology Seminar**

University of Texas, Lyndon B. Johnson School of Public Affairs. 1973. 144 pages.

PB-226 064

This document is comprised of 13 papers presented at a symposium held in the spring of 1972. The subjects covered include: Urban technology in perspective; technology and public policy; opportunities and problems in technology use; an integrated municipal information system; techniques for emergency facility location and refuse vehicle districting and routing; data display techniques for programming and controlling capital improvements projects; recent developments in the technology of solid waste disposal; a law enforcement standards laboratory; applying research results in street construction and maintenance; potential of water desalination for domestic water supply; technology problem definition; management requirements in using technology to upgrade municipal services; future of urban technology.

## **Reference Bookshelf**

### **Information Technology for the Retail Industry**

National Bureau of Standards  
Series made March 15, 1972 at a National Retail Merchants Association Conference in the National Bureau of Standards. 1972. 66 p. \$4.50. COM-72-10495

### **Research and Development in Water Resources**

National Water Commission, Arlington, Va.  
Describes the role of water resources research within the Federal and non-Federal R&D spectrum with special emphasis on policy implication. Jan. 1972. 240 p. \$6.75. PB-212 663

### **Technical & Financial Assistance for Air Pollution Control**

Environmental Associates, Inc., N.Y.  
Describes Federal, state and local government financial assistance available to business and industry in dealing with abatement regulations and including a review of state-by-state tax incentive rules. Nov. 1971. 55.45. PB-210 670

### **Interactive Television Prospects for Two-Way Service on Cable**

RAND, Santa Monica, Calif.

Thoroughly describes development of cable television, the technical, economics, and regulatory forces that influence it and the public policy issues that it raises. 107 p. \$5. PB-212 663

### **Industrialized Housing: An Inquiry into Factors Influencing Entry Decisions by Major Manufacturing Corporations**

National Academy of Engineering, Wash., D.C.

Explores whether a privately-based, production-oriented approach could significantly reduce housing costs and simultaneously upgrade housing quality. Study concludes that: institutional constraints inhibit high-impact technical response to housing solutions cannot alone resolve socially-based problems; corporations would not, contribute to an improved housing stock by merely adding capacity through expanded mass production methods. 1972, 54 p. \$4.50. PB-213 973



## MACHINERY

### Modern Methodology of Designing Target Reliability into Rotating Mechanical Components

University of Arizona, College of Engineering. Dimitri B. Kececioğlu and Louie B. Chester. January 1973. 198 pages.

N73-19465

This document describes a methodology for designing specified reliabilities at optimum size and weight into rotating mechanical components subjected to fatigue under combined alternating bending stress and constant shear stress. Three newly designed fatigue reliability research machines are also described. The machines are capable of applying desired levels of alternating bending moment and constant torque to rotating test specimens. Several computer program listings are appended that should be useful in working with various aspects of the type of problem under consideration. Finally, a review of the literature on cumulative fatigue theory is made, and a number of methods for making cumulative fatigue reliability predictions are explored.

### First Symposium on Rolamite

University of New Mexico, Institute for Social Research and Development; and Sandia Laboratories, Office of Industrial Cooperation. Donald D. Eulert (Ed.) 1969. 189 pages.

PB-226 138

The rolamite is a recently developed, extremely adaptable, low-friction, suspension system capable of simultaneously providing all the ingredients needed to build most kinds of mechanisms and mechanical devices. Some of the many potential applications of the rolamite have been realized and others are undergoing development. The basic rolamite geometry consists of two cylindrical rollers whose motion is restricted by a thin flexible band and two parallel guide surfaces. This document is comprised of the proceedings of a symposium that took place approximately one year after the release of the rolamite to the public. The first section deals with a history of rolamite's development and its fundamental features and capabilities. There follows a series of papers dealing with these topics: Accomplishing useful device functions with rolamite; rolamite geometry and force analysis; dynamic response of rolamite; material properties and tolerances in rolamite bands; rolamite design using figures of merit. The final sections of the document contain transcriptions of workshops on the practical applications of rolamite. These workshops dealt with: Bearings and suspensions; use of rolamite in instruments; electromechanical devices; fluid devices, such as valves, pneumatic control

systems, and accelerometers; theory and force generation; materials used in rolamite construction; electrical switching applications; transducers and measurement devices; processes for the manufacture of rolamite devices.

### An Evaluation of the Stratified-Charge Engine (SCE) Concept

Cornell Aeronautical Laboratory, Inc. L. Bogdan, H. McAdams, and D. J. Schuring. January 1972. 182 pages.

PB-226 738

The stratified-charge engine is a hybrid power plant for certain small passenger vehicles aimed at reducing exhaust emissions. It is described as combining key features of spark ignition and compression ignition, fuel injection permitting operation at lean air-fuel ratios and high compression ratios. Benefits discussed are economies, efficiency of power output, smooth combustion, and good cold start characteristics. An account is given of preliminary studies of the stratified-charge engine for light duty vehicle applications. To augment the limited data base and for analogy and comparison, statistical analyses are also presented of emissions data for conventional automobile engines. New hardware requirements are identified. A few other pertinent topics are design criteria; fuel injectors; flow rates; hydrocarbon, nitrogen oxides, and carbon monoxide; and odors.

## MANUFACTURING METHODS

### Explosive Forming: A DDC Bibliography

Defense Documentation Center. January 1974. 172 pages.

D-773 260

This bibliography contains abstracts on the class of metalworking techniques known as explosive forming. It includes materials on high-energy rate forming, pressure forming, and explosion welding. The period covered is 1960 through late 1973. Subject and author indexes are included. The reports listed in the bibliography are available from NTIS. (This bibliography supersedes an earlier edition, AD-710 550, which was described in AMTID, January 1972, page 45.)

### Quenching (Cooling): A DDC Bibliography

Defense Documentation Center. February 1974. 295 pages.

D-773 475

This bibliography contains abstracts of reports relating to the various techniques of quenching metals and alloys to optimize their properties. The period covered is 1960 through 1973. Subject and author indexes are included. The reports listed in this bibliography are available from NTIS. (This bibliography supersedes an earlier edition, AD-704 400, which was described in AMTID, April 1972, page 78.)

### Unconventional Welding Processes: A Bibliography

Ridge National Laboratory. Ruth M. Stemple. March 1973. 66 pages.

NL-TM-4133

Newer methods, for welding, termed "unconventional" in this document, include electron beam welding, laser beam welding, ultrasonic welding, and friction welding. This bibliography brings together the world literature on these processes through 1971. A separate section is devoted to each process; each section includes an introductory text, briefly describing the process, and a subject index. More than 1100 references are included.

### Compilation of Technical Papers Presented at the SME Clinic on Precision Machining and Gaging

Society of Manufacturing Engineers; and Union Carbide Corp. M. A. Broders and L. G. Whitten, Jr. November 1972. 384 pages.

Y-SB-186

This document contains 34 papers presented at a clinic held (in November 1972) to consider problems and achievements in the field of precision machining and gaging. The information presented concentrates on the high-accuracy, close-tolerance aspects of precision machining, dimensional measurement, and gaging. The facility and environment for precision machining and gaging are discussed, and equipment and procedures used to test and evaluate the performance of machine tools and inspection equipment are described. The latter include high-speed photography and interferometric measurement techniques. Demands for higher accuracy and closer tolerances in manufacture have led to the development of precision machine components such as air-bearing spindles and automatic tool-setting devices. Some of these components and their applications are described. Numerical and computer controlled machines used for machining and inspection of complex, close tolerance parts are also described. The importance of routine and preventive maintenance of both precision machines and associated control systems are emphasized. (Note. The papers in this compilation are also available individually. See pages 55 thru 58 of the April 1973 issue of AMTID.)



## MATERIALS

### Literature Survey on Thermal Degradation, Thermal Oxidation, and Thermal Analysis of High Polymers

Plastics Technical Evaluation Center. Eleanor C. Schramm and David W. Levi. January 1972. 189 pages.

AD-759 530

This is a survey of the worldwide literature on the thermal degradation, thermal oxidation, and thermal analysis of polymeric materials. A total of 1924 references are included; many are annotated. The coverage is approximately from January 1969 to January 1972. The entries are grouped according to type of polymer. A subject and an author index are included.

### Ceramic Materials in Rolling Contact Bearings

Norton Co., Industrial Ceramics Div. M. M. Wheildon, H. R. Baumgartner, et al. February 1973. 91 pages.

AD-761 200

Ceramic materials offer many interesting properties that suggest their use in bearings. Among these are: Light weight, high mechanical strength in compression, resistance to corrosion, low coefficient of friction, dimensional stability, and high hardness over a wide temperature range. In addition, they may also be characterized by high resistance to wear, low coefficient of thermal expansion, very high melting point, and ability to hold close tolerances and fine finishes. This document concerns an investigation of high strength ceramics as rolling contact bearings for applications involving heavily loaded conditions. After an evaluation of a number of candidate materials, silicon nitride, silicon carbide, and aluminum oxide were selected for full bearing fabrication and testing. Of these, fully dense silicon nitride appears to be the most promising. This material appears to be a unique ceramic in that it fails by spalling, rather than from catastrophic cracking. Consideration is given in this report to rolling contact fatigue, friction and wear testing environmental testing, fabrication of ceramic roller bearing and metal components, and rolling contact fatigue test results.

### Performance of 10 Generic Coatings During 15 Years of Exposure

Naval Civil Engineering Laboratory. C. V. Brouillette and A. F. Curry. April 1973. 54 pages.

AD-762 408

This report provides the results of tropical and subtropical marine atmospheric environment tests of protective coatings for steel. The performance of 49 different coating systems, which were exposed for periods of up to 15 years

are discussed. Each of the coating systems belonged one of the following general types: Vinyls, bituminous coatings, phenolics, synthetic rubbers, urethanes, coal blends, epoxy resins, zinc-rich coatings, metallized coatings, and miscellaneous coatings. The best performances were obtained with zinc-rich coatings and a modified phenolic system. Very good performance for periods of four years or more was obtained with a number of other systems.

### Protective Treatments (Industrial Process): DDC Bibliography

Defense Documentation Center. February 1974. pages.

AD-773 550

This bibliography contains abstracts of reports in the field of protective treatments applied to materials. Specific types of treatments considered are anodic coatings, antifouling coatings, and diffusion coatings. The period covered is 1953 through mid-1973. Subject and author indexes are included. The reports listed in this bibliography are available from NTIS. (This bibliography supersedes a previous edition, AD-722 800, which was described in AMTID, January 1972, page 13.)

### Control of Algal Growth on Paints at Tropical Locations

Naval Civil Engineering Laboratory. R. W. Drisko and B. Crilly. December 1973. 30 pages.

AD-774 481

Microscopic black plant growths cause unsightly stains and costly maintenance to both painted and unpainted buildings in many tropical areas. These growths are especially prevalent in damp areas on concrete buildings. When they occur on walkways during the rainy season, the slippery surfaces constitute a hazardous condition. This report describes screening tests of various combinations of paint pigments and biocides for use in paint to control these algal growths. It was found that the bismuth tributyltin oxide in polyvinyl acetate paints completely inhibited algal growth at 0.1% concentration. Barium metaborate paint pigment in two different acrylic paints also completely inhibited algal growth.

### Criteria for Selecting Resin Matrices for Improved Composite Strength

Lewis Research Center (NASA). C. C. Chamis, I. Hanson, and T. T. Serafini. February 1973. 34 pages.

N73-15597

There are many resin matrices that can be used to make fiber reinforced plastic composites. These matrices



properties differing in modulus, toughness, elongation, strength, and strength retention at elevated temperatures. The researcher and designer are confronted with the problem of selecting matrices from this number that will yield composites with specified properties. The main difficulty is that the properties of the matrix resin itself do not transfer to composite mechanical properties in a parallel correspondent manner. This document presents criteria that can be used a priori to select matrices to yield composites with improved unidirectional strength. These criteria can also be used to guide polymer researchers to develop new matrices. A new standard procedure for determining initial matrix modulus is also suggested.

### **Friction and Wear Behavior of Glasses and Ceramics**

Lewis Research Center (NASA). Donald H. Buckley. August 1973. 38 pages.

**73-25632**

This is a review of those fundamental characteristics of glasses and ceramics that exert and influence on their adhesion, friction, and wear behavior. These include mechanical, chemical, and physical behavior. In addition, those factors that dictate the friction and wear characteristics for glasses and ceramics in contact with metals are reviewed.

### **Technological Innovation in the Production and Utilization of Materials**

National Commission on Materials Policy. Allen F. Agnew (Ed.). August 1973. 223 pages.

**B-223 679**

This document is comprised of papers presented at and prepared as a result of a forum on the needs and the impact of technological innovation in the materials producing industries. The forum was held at Pennsylvania State University in June 1972. The topics of the presented papers include the following: Need for increased basic and applied research in mature industries; modern practice and technological practice in the nonferrous metals industries; role of secondary materials; opportunities for innovative developments in coal; innovation in power generation from coal; synthetic pipeline gas from coal; role of materials in modern ceramics; future requirements for ceramic technology; critical role of engineering in innovation of polymeric materials for public technology; economics of materials substitution. Additionally, a number of papers were issued as the result of workshop sessions. These papers deal with technological innovation in iron, steel, and nonferrous production metallurgy; coal; ceramic materials; polymeric materials; substitution technology; and materials education.

### **Forum on Materials Deterioration. Construction Materials, Textiles, and Forestry and Forest Products**

National Commission on Materials Policy. Allen F. Agnew (Ed.). August 1973. 171 pages.

**PB-223 680**

This document is comprised of formal presentations given at a forum on resource management and research needs in several areas of materials technology. The forum was held at Georgia Institute of Technology in October 1972. The subjects covered include: Assessment of materials limitations; deterioration of synthetic plastics and recycling; problems and requirements in the area of transportation and construction materials; nonmetallic minerals of construction; textile requirements for the 1980's; forest management and conflicts in land use; use of forest-products residues; world import functions for the paper industry. In addition, several workshops were held during the forum and the reports issued by them are included. The topics include: Deterioration of engineering materials; transportation and construction materials; synthetic and natural textiles; and forestry and forest products.

### **Improved Utilization of Construction Materials**

Massachusetts Institute of Technology, Department of Civil Engineering. George Vernon Jones. June 1973. 256 pages.

**PB-224 244**

It is expected that in the next 30 years the additional constructed facilities demanded by society will be approximately equal to the facilities that now exist. The question arises whether the materials required for the increased construction will be available. The investigation attempts to answer this and related questions, noting that supplies of natural resources get increasingly scarcer as demands increase exponentially. Some offsetting measures are discussed, such as reduction of the demand for virgin resources by recycling construction and demolition wastes. Another is increasing facility lifetimes. A third is reuse of components or entire structures. Present trends toward off-site fabrication appear promising in this direction. Comments are on the supply and demand for such construction materials as iron, aluminum, copper, concrete, and plastics; and feasibility studies are made of the wrecking industry, waste utilization, and salvage of materials.

### **Proceedings of the Third Annual Symposium on Reduction of Costs in Hand-Operated Glass Plants**

West Virginia University, College of Engineering. R. P. Smith (Ed.). May 1972. 102 pages.

**PB-225 700**

This document contains papers presented at a symposium for owners, managers, supervisors, engineers, and plant operators of hand-operated glass plants, and which was aimed toward the minimization of costs and the solution of plant problems. Topics of the papers include: Lithia boosting of soda-lime glasses; a new approach to metallic application in glass decorating; a new look at the old art of mixing; the mold polishing revolution; heat and energy recovery for the glass industry; glass plant education in certain foreign countries; and the use of cast refractories. Appended to the proceedings is a manual entitled *Training Guidelines—Hand Blowing, Pressing, and Shaping of Glass*, prepared by the Ceramics, Glass and Mineral Products Industry Training Board.

### **Properties of Carbon Derived from Petroleum Pitches**

Union Carbide Corp. O. J. Horne, W. E. Smith, and Napier. June 1973. 41 pages.

**Y-1875**

Carbon possesses a number of properties that make it a very interesting potential structural material in a number of applications. These properties include: High-temperature heat resistance; resistance to chemical attack; consistency of properties over a period of time; a high strength-to-density ratio; and a variety of forms in which carbon can conveniently be made and the variety of properties that these forms can impart in structural applications. The properties of carbon are largely determined by the molecular structures of the precursor materials and the reaction mechanisms that the precursors undergo to become carbon. One potentially useful carbon precursor is petroleum pitch. The effect of temperature and various additives on the properties of petroleum pitches, and carbons derived from these pitches, is described in this report. The pitch properties of concern are molecular weights, softening points, and benzene insolubles. It is shown that by proper selection of pitch and blending various additives prior to pyrolysis, a wide variety of carbons may be obtained, thus affording avenues to control carbon properties by controlled modification of the precursors.

## **Best Sellers from PLASTEC— Plastics Technical Evaluation Center**

**Solid-Phase Forming (Cold Forming) of Plastics**—Discusses the forming concepts involving the use of traditional metal working techniques which are new to the field of thermoplastic part production. 1972. 104 pp. PC \$10/MF Not Available. order AD-752-136/G

**Plastics Fabrication by Ultraviolet, Infrared, Induction, Dielectric and Microwave Radiation Methods**—Brings you up-to-date with the progressive evolution of non-ionizing radiation methods. Gives guidelines to the advantages, disadvantages, and general economics in using these processes—crosslinking or curing, heating and drying, bonding, thermoforming, and preheating for transfer molding. 1972. 106 pp. PC \$11/MF \$11 order AD-756-214/G

**Compatibility of Explosives with Polymers (III)**—Records compatibility testing of polymers and explosives during 1969-1970. This report, with Plastec Note 22 and Plastec Report 33, gives a complete record of such data for a 20-year span. 1971. 87 pp. PC \$6/MF \$1.45 order AD-721-004/G

**Literature Survey on Thermal Degradation, Thermal Oxidation, and Thermal Analysis of High Polymers IV**—bibliography of 1924 references, many of them annotated covering from about Jan. 1969 to Jan. 1972. References are grouped under general and material headings and include a subject and an author index. 1972. 184 pp. \$12/MF \$12 order AD-759-530/G

**Polyurethane Foams: Technology, Properties and Applications**—Gives the complete technology of urethane foams—chemistry, types, methods of manufacture, properties, test methods, military and space applications, standards and specifications. 1969. 246 pp. PC \$15.50/MF Not Available. order AD-688-132/G

**Environmentally Degradable Plastics: A Review**—Reviews mechanisms for degrading plastics, and companies and universities involved in the degradation technology; suggested applications, military problems with degradable plastics, and the future outlook for degradable materials. 1973. 22 pp. PC \$4/MF \$4 order AD-760-718/G



## METALS

### Plane Strain Fracture Toughness Data Handbook for Metals

Army Materials and Mechanics Research Center. William T. Matthews. December 1973. 88 pages.

AD-773 673

A compilation of plane-strain data is presented for metals manufactured in US and in Europe, including 50 steels, 1 titanium alloys, 38 aluminum alloy, and one beryllium material. The data correspond to a static laboratory loading of one to three minutes duration. The effect of temperature is included, along with the direction of testing, the form and size of the material, its composition and heat treatment, and the specimen type and size. The bulk of the information appears in tabular form. Steel categories are low alloy, nickel, maraging, stainless, low strength, and intermediate strength. Aluminum alloys include those containing copper, zinc-magnesium, zinc-magnesium-manganese, and a few others. Values shown are for various plate thicknesses, forgings, and bars.

### Metallurgy: A Compilation

National Aeronautics and Space Administration, Technology Utilization Office. 1973. 27 pages.

73-25598

Work by NASA laboratories and contractors has resulted in a number of developments in metallurgy that have potential applications outside the aerospace industry. This document provides technical summaries of some of these developments. Two main subject areas are covered. The first concerns the effects of hydrogen on the properties of a variety of metal alloys. The second area concerns the mechanical and physical properties of a wide range of alloys and some of the processes involved in their production. The processes described are free from patent restrictions. Information is provided on how to obtain additional, more detailed documentation on each of the items summarized. Two previous reports in this series contain summaries of other NASA developments in metallurgy: 71-34471 (price \$1.00; see AMTID, July 1972, page 26) and N72-17500 (price \$1.00; see AMTID, October 1972, page 29).

### Copper: A Materials Survey

Bureau of Mines, Division of Nonferrous Metals. Albert Daniel McMahon. 1965. 349 pages.

B-225 138

Copper is one of the few common metals used in the commercially pure as well as the alloyed form. It alloys

readily with other metals such as zinc or tin to form widely used brasses and bronzes, and to produce structural parts where other metals are the principal components. This document provides a survey of the properties, commercial classification, and uses of copper and its alloys. Data are given on primary copper resources, reserves, and mines in North and South America, Europe, Asia, Africa, and Australia, and on secondary resources in scrap and chemical compounds. Consideration is given to the technology of mining, smelting, refining, and fabricating; supply and distribution as well as production and consumption and trade about the world; structure of the industry throughout the world; employment and productivity; research and development; and legislation and government programs.

### Bibliography on Powder Metallurgy

British Steel Corp., Information Services. A. M. Healey. October 1973. 149 pages.

PB-225 705

The bibliography contains 749 references selected from the worldwide literature published from January 1972 to March 1973. The content relates predominantly to ferrous metallurgy, dealing with all stages in processing from powder production to the properties of finished parts. The general categories are general articles, powder production technology, properties of powders; compaction of powders by pressing, isostatic techniques, rolling, and others; sintering of compacts, forging of sintered parts, properties of powdered metal (P/M) parts, uses of P/M and P/M parts, and miscellaneous discussions. Most of the entries are accompanied by an abstract.

### Basic Oxygen Steelmaking: A Bibliography of Published Literature 1971-72

British Steel Corp. R. L. Davies. October 1973. 55 pages.

PB-225 714

The bibliography contains 287 references to the worldwide literature on basic oxygen steelmaking (BOS). Subjects covered include: Lime and alternatives; scrap use; refractories; process reactions, including the effect of variables and production techniques; lances and lancing; gas cleaning; dust collection; use of waste oxygen blowing; planning and design aspects; instrumentation including automation, control, and modeling; and world BOS plant data. Abstracts are provided for most of the entries.



## Separating Copper from Scrap by Preferential Melting. Laboratory and Economic Evaluation

Bureau of Mines. Vance G. Leak, M. M. Fine, and Henry Dolezal. 1973. 52 pages.

PB-226 090

A method for the separation and recovery of copper and steel from scrap in which substantial percentages of both metals are present (eg, motor armatures) is described and evaluated. The method employs preferential melting in molten salt. The molten salt, preferably barium chloride or calcium chloride, minimizes oxidation of the metals and promotes heat transfer. The cleanest separations are achieved by pretreatment with sodium sulfate or sodium silicate, which alters and coats the surface of the iron to inhibit alloying or brazing with copper. A cost of about US \$0.20 per pound of copper recovered has been determined for the process.

## Iron: A Material Survey

Bureau of Mines, Division of Ferrous Metals. Horace Reno and Francis E. Brantley. January 1974. 120 pages.

PB-228 149

This document provides a survey of the iron ore industry of the world. It presents a statistical record, through 1970, of the iron ore industry and world trade patterns. The supply position of the major iron-producing countries is summarized, and detailed information is given on production of iron ore, consumption, imports, exports, mine capacities, substitutes, properties, and uses. There is a generalized discussion of the technology of mining and smelting iron ore, with a selected bibliography on the current state of these arts. A summary economic account is also provided of world iron ore resources, and the structure of the principal world iron mining industries, iron ore mine employment and labor productivity, research and development, legislation, and government programs are all discussed.

## The Best from MCIC

### —Metals & Ceramics Information Ctr.—

**Damage Tolerant Design Handbook**—A compilation of fracture and crack-growth data for high-strength alloys. A comprehensive source of all fracture mechanics data for . . . high-strength aluminum alloys . . . alloy steels . . . stainless steels . . . titanium alloys. Covers:

- plane-strain fracture toughness data ( $K_{Ic}$  values)
- plane-stress and transitional fracture toughness data ( $K_c$  values)
- Threshold stress intensity in corrosive or embrittling environments ( $K_{Isc}$  values)
- sustained-load crack-growth rate in corrosive or embrittling environments ( $da/dN$  vs  $K_I$ )
- fatigue crack growth rate ( $da/dN$  vs  $\Delta K$ )

Plus—special section on comparison of alloys by fracture mechanics properties, 206 references and appendix covering testing methods and conditions, code for data sheets, abbreviations, and symbols.

1972. 431 pp. PC \$37.50/MF \$37.50 order AD-753-774/G

### Advances in Joining Technology—The '60's and Beyond

—Tells how you can put advances in welding technology to work for you. A survey of the most significant advancements in welding technology since 1960. Describes both new welding techniques and recent improvements in established welding methods.

1973. 68 pp. PC \$12.95/MF \$12.95 order AD-754-262/G

**Symposium on Electrodeposited Metals as Materials in Selected Applications**—This comprehensive collection offers information on:

- The physical properties of the precious metals
- Properties of electrodeposited foils for use in printed circuits
- Properties of electroless cobalt and recording technology
- Strength and ductility of electroformed nickel
- Nickel electroforming applications—why they exist
- Mechanical properties of electrodeposited lead and lead alloys
- Maintaining structural integrity of aerospace components
- Electroplate property specifications for metal fasteners
- Joining aluminum to stainless steel by electroplating

1972. 131 pp. PC \$7.50/MF \$7.50 order AD-738-272/G

### Bibliography on Fibers and Composite Materials—

**1972**—Here's a good place to check what's been done in the field before initiating any research work. More than 3,000 references are included—even translated items from Japan, West Germany, U.S.S.R., and other nations. Arrangement of the references by subject makes identification of key publications on a given composites-related subject quite simple. If your field of interest is in aerospace construction, materials development and manufacturing building materials, you'll want to add this bibliography to your reference bookshelf.

1972. 103 pp. PC \$8.50/MF \$8.50 order AD-746-214/G

# MINING & MINERAL INDUSTRIES

## Solvent Extraction of Uranium Ores

Australian Atomic Energy Commission. E. A. Newland. July 1972. 112 pages.

AAEC/LIB/BIB—361

This document is comprised of bibliographic references to the literature on the solvent extraction of uranium ores. A preliminary section cites references to the basic literature on solvent extraction in general. The period covered is 1945 through mid-1972.

## Bureau of Mines Research 1972: A Summary of Significant Results in Mining Metallurgy and Energy

Bureau of Mines. 1972. 87 pages.

PB—220 080

An annual report on mineral research summarizes a variety of investigations on the extraction, processing, use, reuse, and disposal of minerals and fossil fuels. Under mine health and safety, consideration is given to respirable dust, coal fragmentation, noise studies, noxious gases, toxic materials, methane control, disaster survival and rescue, hazards, and illumination. Explosions research involves, explosive materials, fire studies, accident prevention, and blast patterns related to geologic structure. Under metallurgy are processes such as stabilization of tailings flotation, and slimes dewatering. Hydrometallurgy includes the recovery of gold, molybdenum and rhenium, and leaching low grade copper ore; pyrometallurgy includes removal of base metals from scrap iron, lime roasting of chalcopyrite, and extraction of copper from sulfide ores. Recycling deals with minerals and metals recovery from urban refuse, automobile shredder rejects, steelmaking dusts, and base metal processing wastes. Adaptive metallurgy includes pneumatic drill noise abatement, and the improvement of lead and steel alloys. Energy research concerns coal, petroleum, natural gas, and oil shale.

## Extraction of Energy Fuels

Federal Council for Science and Technology. September 1972. 254 pages.

PB—220 328

This document provides a technical assessment of several fuel extraction technologies. The functional areas of concern are: Stimulation of petroleum and natural gas production by such methods as fluid injection, earth fracture systems, and explosive fracturing; production of

oil from tar sands (or bitumen-bearing rock) by steam injection, in situ combustion, solvent extraction, hot-water and hot-gas injection, nuclear applications, and mining methods; oil shale as an energy source; underground gasification of coal; oil and gas production from organic wastes; and primary extraction of coal with respect to surface mining, underground mining, mine-associated fires, acid mine waters, and mined land reclamation. In each case, consideration is given to the current status of technology, probable ultimate potential, and research and development requirements.

## Sulfur Coatings for Mine Support

Southwest Research Institute. John M. Dale and Allen C. Ludwig. November 1972. 46 pages.

PB—220 408

The advantages and practical aspects of using sulfur as a construction material have largely been overlooked in the past in favor of using sulfur as a chemical feedstock. Recent developments in mixing sulfur with various materials, and altering its physical properties chemically, have shown it to have considerable potential for a variety of new applications. This document describes a sulfur-based formulation that was developed to be used as a coating capable of both sealing and supporting mine walls and ceilings. The formulation is comprised of sulfur containing relatively small amounts of talc, milled glass fiber, and cyclopentadiene. It can be applied as a spray to overhead as well as other surfaces. Furthermore, it can be prepared and dispersed from a completely self-contained portable application unit at remote sites. The coating would appear to have considerable potential for a variety of other applications, such as ground coatings for dams, spillways, catch basins, tailings stabilization, etc.

## A Mineral Slurry Data Bank

PB—220 566 Part 1: Report. 121 pages.

PB—220 567 Part 2: Appendages—Computer Output. 242 pages.

Colorado School of Mines, Basic Engineering Department. R. R. Faddick. December 1972.

Attention is focusing on the health and safety records of the mining industry, particularly coal mining because of worker exposure to large quantities of respirable dust, explosive dust, and methane gas. One approach to reducing the accident rate is adaptation of slurry pipelining—mixing ore with water and then piping the resulting slurry to the surface, thereby alleviating or eliminating the dangers of dust and noxious gases. Special advantages are that a slurry pipeline allows more room in the shaft and drifts requires fewer men to operate, and reduces ventilation problems. Solids pipelining has not realized full potential underground because of limitations in both theory and technology. There is a lack of hand-



book material, so the mining engineer must rely on pilot plant studies from which slurry pipelining data are available. By organizing a computer data bank for mineral slurries and analyzing its data, a larger opportunity is afforded for synthesizing an understanding of solids-liquid flow. The report is intended to correlate headloss and friction loss data for mineral slurries in the form of ore, concentrates, or tailings. Also included are definitions of flow regimes and pipeline design velocities. It is noted that homogeneous slurries flow like paste or mud, but are the easiest to handle mathematically. Volume One contains descriptive material, formulations, tabulations, and graphic presentations. Volume Two contains the data bank in the form of a computer printout. It lists system constants and headloss data for each of 16 materials, including coal, coal refuse, ores, concentrate, and tailings.

### **Technologic Trends in the Minerals Industry, 1971**

Bureau of Mines. 1973. 65 pages.

**PB-223 746**

The report summarizes information on the latest technological developments and identifies trends in mining and metallurgy, based on a review of activities in the 1971 minerals industry. Some of the topics covered are fragmentation by drilling, blasting, and machine excavation; ground support and control trends; materials handling; environment, health, and safety; beneficiation; hydrometallurgy; pyrometallurgy; electrometallurgy; waste treatment; value of principal mineral products; comparison of production from surface and underground mines; ratio of ore treated to the marketable product; exploration and development; and explosives. New tunneling machines for both soft and hard ground are also discussed.

### **The State-of-the-Art in Continuous Mining Machine Bit Technology**

Bituminous Coal Research, Inc. Kenneth L. Whitehead and Robert D. Saltsman. June 1973. 226 pages.

**PB-225 633**

The occurrence of pneumoconiosis or black lung disease has been associated with respirable coal dust to which coal miners have been exposed. As a result, and following legislation imposing restrictions on respirable dust concentrations, research is being applied to finding methods of eliminating or suppressing this dust. This document gives the results of a study undertaken to determine the state of the art in continuous mining machine technology, especially with respect to the drilling bits used. Recommendations are made dealing with determination of bit performance and development of new bit designs and materials. The willingness of the manufacturers to cooperate in the development of new equipment and techniques is noted.

### **Extinguishment of Rock-Covered Mine Fires**

Atlantic Research Corp. Edward T. McHale. September 1973. 69 pages.

**PB-225 831**

A rock-covered coal fire in an underground mine may result from a roof fall and ignition from an existing fire or from severed electric cables. The burning coal receives sufficient aeration to sustain intense combustion although massively buried. All the problems of other underground mine fires exist, plus the hazard of a potential explosion from accumulation of flammable gases distilled from the hot coal. The two current methods of control have drawbacks. The loading out process—drenching the debris face with water, removing material until more burning coal is reached, and repeating the process—is time consuming and hazardous to personnel. Driving high expansion foam into the roof fall heap with generating equipment sealed into the mine entry does not meet the cooling-extinguishing requirements for efficiency. An alternative technique is needed. The report discusses the use of plain water and nonaqueous agents, leading toward the selection of water through sparger tubes in high pressure jets. Water, because of its high heat extraction capability, appears superior to other agents in these fires. Laboratory tests and conclusions are presented.

### **Influence of Mine Fires on the Ventilation of Underground Mines**

Michigan Technological University, Department of Mining Engineering. Rudolf E. Greuer. July 1973. 178 pages.

**PB-225 834**

Every mine contains inflammable materials in the form of materials mined or supplies brought in, so the possibility of a fire will always exist. The greatest hazards of mine fires are poisonous or explosive combustion products, carried by ventilation within the mine. To combat such hazards flow paths must be known. The report deals with the effects of accidental fires in underground mines on underground mine ventilation. The primary objective of study was to obtain and evaluate all the information on methods of disturbance prediction available, mostly from foreign sources. Aspects for particular consideration are mine fire properties, fume temperatures behind the fire zone, forces developed by fumes, and qualitative and quantitative predictions of disturbances. It would appear that fire-ventilation flow interactions can be predicted with more accuracy than was previously assumed. The materials in the report should be of much interest to mining engineers.



## **Radiation Halos and Hydrocarbon Reservoirs: A Review**

Bureau of Mines, Bartlesville Energy Research Center. E. Armstrong and R. J. Heemstra. March 1973. 57 pages.

**PB-226 788**

This document reviews the literature dealing with the possibility that a "radiation halo" surrounds oilfields and gasfields. Proof of the existence of such a halo would obviously be a valuable step forward in petroleum exploration. Many theories and documented surveys both in support and refutation of this reported phenomenon are discussed. Some of the topics covered include: geochemical anomalies, geochemical prospecting, hydrocarbon anomalies and prospecting, radioactive anomalies, significance of the uranium-hydrocarbon, significance of radioactive groundwater, radiometric prospecting, detection methods for radiometric exploration, airborne radiometry, and lithological normalization. A bibliography of 237 items is included.

## **How to Find Abandoned Wells: A Manual**

Bureau of Mines, Bartlesville Energy Research Center. Kenneth H. Johnston, Herbert B. Carroll, and F. E. Armstrong. March 1973. 51 pages.

**PB-226 789**

In a number of cases where a petroleum source has been discovered beneath a bituminous coal bed, wells are drilled through the coal seam to obtain the oil or gas available. When the supply is exhausted, the wells are abandoned, sometimes improperly plugged, and the abandoned cavities present a hazard to coal mining operations. The report is designed to furnish the coal industry with a description of techniques, instruments, and clues for finding these abandoned oil and gas wells. Information is given on searching techniques currently in use by coal mining companies, gas transmission organizations, and waterflood operators. The role of methane detectors to locate abandoned wells is described. Of particular importance are clues that an experienced searcher can recognize at an uncharted site, such as old roads, previous tank locations, scars and deformities in trees, and large timbers discarded in the area. Some tests and test results are discussed.

## **Recent Developments in Coal Mine Fire and Explosion Prevention Research**

Bureau of Mines, Pittsburgh Mining and Safety Research. Joseph Grumer. 1973. 24 pages.

**PB-227 100**

This report describes recent results from a program of fire and explosion research, which includes projects in

the technical categories of ignition, propagation, detection, and extinguishment. Primary objectives are to detect and quench ignitions of gas in the mining coal face area, to detect and quench explosions in rock dusted coal dust with passive or triggered barriers, and to detect incipient fires early enough for easy extinguishing. Intrinsically safe equipment and wiring are sought that, under either normal or abnormal conditions, cannot release enough electrical or thermal energy to cause a gas ignition. The break spark is of particular concern in electric circuits. Attention is given to frictional ignition from sparks generated when cutting bits strike hard inclusions in coal, or when aluminum material strikes rusty iron. Much study is devoted to the obscure phenomena of coal dust combustion with or without methane concentrations. The report describes wind tunnel investigations of dust behavior, and explosion tunnel tests of interacting gas and dust deposits. Characteristics of detectors are discussed. Data are given on sprays, experimental extinguishing equipment, meters and samplers, and entry surveys.

## **Extraction of Silver from Refractory Ores**

Bureau of Mines, Reno Metallurgy Research Center. B. J. Scheiner, D. L. Pool, et al. 1973. 15 pages.

**PB-227 190**

Most silver is now extracted from its ores by the cyanidation process. However, not all silver ores are readily amenable to cyanidation and those that are not present a serious problem to the mill operator. Manganese minerals, for example, can seriously deter the extraction of silver by cyanidation. This report presents the results of leaching studies on refractory silver ores and dump materials. Application of the knowledge obtained from these studies has resulted in the development of a sulfur dioxide-sodium chloride leaching sequence for extracting silver from these types of ores. Silver extractions of 80-85% were obtained with this sequence, which is an increase of 9-61% over the yield obtained with the same ores using conventional techniques.

## MISCELLANEOUS

### Photomicrography: A DDC Bibliography

Defense Documentation Center. January 1974. 462 pages.

AD-772 800

This bibliography contains abstracts of reports on the techniques and applications of photomicrography. The references and their accompanying abstracts are arranged into seven sections: Biological, botanical, and medical applications; coatings, fibers, graphite and plastics; equipment and techniques; films, graphs, images, and lasers, inorganic chemistry, metallurgy and metallography; miscellaneous. The period covered is 1953 thru late 1973. Subject and author indexes are included. The reports listed in the bibliography are available from NTIS.

### Report of the 12th Parallel Survey

Defense Mapping Agency Topographic Center. July 1973. 70 pages.

AD-773 771

Geodesists have long been concerned with separation information to determine the size and shape of the earth, and with constructing a best fitting ellipsoid to portray it. Lack of detailed information has been detrimental to the program. One area for which data have not been available is the 12th parallel in Africa, extending the continental breadth from Dakar in Senegal to the eastern edge of Ethiopia. The report covers a survey across the 30 in. isohyetal line, involving elevations from 300 to 2000 feet, semiarid areas, regions with roads impassable during the rainy season, flat and broken countrysides, and barren as well as vegetated lands. Observation towers and explorations are described, along with hazards, weather conditions, transportation characteristics, and difficulties.

### Proceedings of the 24th Annual Industrial Engineering Conference

West Virginia University, Department of Industrial Engineering. July 1973. 97 pages.

PB-225 754

This document is comprised of papers presented at a regional industrial engineering conference held in Morgantown, West Virginia, in April 1973. The papers are largely tutorial in orientation. The topics covered include: Resource management; impact of safety on productivity and resource management; incentive management; role of the industrial engineer in resource management for the future; resource management and human values; capital investment and productivity; use of data processing for the application of maintenance standard data; rockbolting with polyester resins; profit improvement using value analysis; the nature, history, application, implementation, and teaching of operations research techniques for effective leadership.



## PUBLIC HEALTH

### Determination of Optimum System and Aircraft for Aerial Dispersal of Insecticides for Control of Insects of Medical Importance

University of Florida, Department of Entomology and Nematology. C. T. Adams, Sr. and W. G. Eden. July 1973. 59 pages.

AD-772 002

For many years workers have sought to find the appropriate place for aircraft in the field of medical pest control. Since the earliest days of the aircraft industry some entomologists have attempted to use this vehicle effectively in the field. This report describes the results of an extensive survey to determine the most desirable systems characteristics for use in the aerial application of insecticides. A study of droplet size formation is presented, and this appears to be the most critical single factor from an economic and operational standpoint. Information on droplet formation through the use of rotary nozzles is reviewed and compared to the droplet production of the hydraulic nozzle. A critical review of currently available equipment is presented and the salient features of each are discussed. A stylized optimum system meeting all criteria set forth in this study is described. A review of commercially available aircraft potentially useful in pest control operations is presented. Also, a review of currently available insecticides for aerial dispersal is presented with unit cost per acre data.

### Control of Rabies

National Academy of Sciences, Subcommittee on Rabies. May 1973. 33 pages.

PB-224 400

This is a summary of the current state of knowledge of the control of rabies, and it presents a series of recommendations based on this knowledge. The topics covered include: Pathogenesis; epidemiology; vaccines, including licensure and testing, development and marketing, and use; population control of rabies vectors; quarantine and postexposure practices; prevention of rabies in man; regulatory aspects of control. (Note. Paper copy available only from: Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20418; price \$2.00. Microfiche copy is available from NTIS).

**The Assistant Medical Officer: The Training of the Medical Auxiliary in Developing Countries**  
Medical College of Virginia. Edwin F. Rosinski and Frederick J. Spencer. 1965. 210 pages.

PB-225 856

The problem of medical manpower, particularly in the developing countries, is an especially acute one and one that will become greatly accentuated in the near future. This book examines the function of the Assistant Medical Officer, whose training falls somewhere between that of the medical doctor and the registered nurse. The examination of procedures employed in selecting candidates for training describes the educational program—premedical, preclinical, and clinical courses—and explores teaching methods, classroom facilities, and testing techniques. Extensive consideration is given to the type of student entering this type of training, with particular attention to cultural differences affecting student performance, and to the type of faculty provided for this program. The duties of the officer are discussed in the light of his legal position as a qualified practitioner of medicine, and the limitations that may be imposed on his methods of clinical practice are presented. His conditions of employment, responsibilities, response to supervision, and the available equipment are noted, as is his role in public health and preventive medicine. In addition, consideration is given to the changing status of the assistant medical officer in the developing countries, especially as it pertains to acquiring a degree in medicine at some later date.

### Patterns of Mortality in Childhood

Pan American Health Organization. Ruth Rice Puffer and Carlos V. Serrano. 1973. 44 pages.

PB-226 337

This document constitutes a summary of the principal findings of the Inter-American Investigation of Mortality in Childhood, which was undertaken on a continental scale to explore in depth the causes of excessive mortality in infancy and early childhood in the Americas, as well as the interrelationships of multiple causes and associated factors. Projects were carried out at 15 locations in 10 countries to establish death rates for infancy and childhood that would be as accurate and comparable as possible, taking into account biological as well as nutritional, sociological, and environmental factors. Countries involved were Argentina, Bolivia, Brazil, Canada, Chile, Colombia, El Salvador, Jamaica, Mexico, and the United States. The topics covered in the document are: Problems in the collection and quality of basic mortality data; birth weight as related to neonatal mortality; mortality in childhood; infant mortality; neonatal mortality; mortality in early childhood (age 1-4 years); infectious and parasitic diseases; nutritional deficiency; congenital anomalies; other diseases and external causes; reproductive patterns of mothers; breast feeding; socioeconomic and related factors; medical attention; environmental conditions.



## Diagnosis and Treatment of Poisoning by Pesticides

Environmental Protection Agency, Office of Pesticide Programs. 1973. 16 pages.

PB-227 053

Pesticide chemicals can be safe and effective when used as recommended. They may be dangerous if directions are not followed. In these cases, accurate diagnosis and prompt treatment could mean the difference between life and death. This document provides a concise outline of diagnosis and treatment procedures. Emphasis is on poisoning by chemicals that are coming into use as replacements for DDT: Organophosphates, carbamates, and chlorinated hydrocarbons. Attention is given to external signs and symptoms of poisoning, supportive therapy, decontamination of the patient, administration of specific antidotes where available, and measures for preventing pesticide poisoning.

## Health Effects of Organophosphate Insecticides

University of Illinois, Environmental Health Resource Center. January 1974. 58 pages.

PB-228 439

Most insecticides can be classified into one of three chemical groups: organochlorines, organophosphates, and carbamates. Since 1945 organochlorines, such as DDT, have had greatest use. However, because of their adverse environmental effects, and the fact that many target insect species are developing a tolerance to them, the organochlorines are now being displaced by organophosphates in many applications. Although the effect of organophosphates is less persistent than the organochlorines, they are generally considered to be much more toxic both to man and insect. Because of this toxicity, and because many users of organophosphate insecticides are ignorant of their health effects, this document has been prepared for the information of environmental and public health workers and the general public. The subject matter covered includes the following: Health effects of organophosphate use; cholinesterases; acute effects; chronic effects; toxicity of individual compounds; synergisms, antagonism, and potentiation; residual effects; contact dermatitis; teratogenic, carcinogenic, and mutagenic effects; populations at risk. Recommendations are offered that are intended to reduce the health hazard risk from organophosphates.

# The Best from NSIC —Nuclear Safety Information Ctr.—

**Reactor Protection System: Philosophies and Instrumentation Reviews from Nuclear Safety**—Summarizes prominent aspects of the design philosophies for the reactor protection system. Proposes that there are many routes to a protection system design, and all designs need not be identical to perform their missions satisfactorily. 1973. 276 pp. C \$15/MF \$15 order ORNL-NSIC-111/G

**Design Data & Safety Features of Commercial Nuclear Power Plants Vol. 11, Docket No. 50-296 through 50-395**—Offers you comprehensive design data, safety features, and site characteristics conveniently summarized for forty-seven commercial nuclear power plants in the U.S. Six pages of data presented for each plant give you:

- Thermal-Hydraulic and Nuclear Factors
- Containment Features
- Emergency Core Cooling Systems
- Site Features
- Circulating Water System Data
- Miscellaneous factors.

An aerial perspective is also presented for each plant site showing relation of plant to cooling water intake and discharge and other environmental factors. 1972. 282 pp. C \$15/MF \$15 order ORNL-NSIC-55/G

**Radiography Incidents and Over-Exposures**—Contains 302 abstracts related to various aspects of radiography operations from June 1963 through Dec. 1971. Includes personnel exposures as well as incidents resulting from personnel and/or management errors and mechanical failure. Provides insight into the possible methods of reducing personnel, operating, and management errors in the field of radiography. 1972. 84 pp. PC \$10/MF \$10 order ORNL-NSIC-53/G

**Calculation of Doses Due to Accidentally Released Plutonium from LMFBR**—Reviews experimental data and analytical models which can be used to assess the transport properties of plutonium aerosols following a hypothetical reactor accident. Covers:

- The Behavior of Released Sodium Oxide and Plutonium-Bearing Particles
- The Transport, Settling, and Redistribution of Aerosols in the Outside Air (Troposphere)
- The Chemistry of Plutonium
- The Intake and Metabolism of Plutonium Dioxide
- The Computation of Internal Dose

1972. 123 pp. PC \$15/MF \$15 order ORNL-NSIC-74/G

## REMOTE SENSING

### Earth Resources Technology Satellite—1: Symposium Proceedings

Goddard Space Flight Center, Laboratory for Meteorology and Earth Sciences. William A. Finch, Jr. (Ed.). January 1973. 171 pages.

N73—19396

This document is comprised of papers presented at a symposium held two months after the launch of the ERTS—1 satellite. It is intended to provide a first look appraisal of the applications of the earth resources imagery obtained through use of the satellite. Some of the areas discussed are: Resource inventories; forestry applications; geologic interpretation, cartographic applications; land use studies; estuarine and coastal oceanography; ERTS—1 data collection system; ice, snow, and permafrost studies; wetland ecology interpretation; crop classification; and urban area studies.

### Remote Soil Moisture Measurements

General Electric Co. E. H. Stockhoff, R. T. Frost and E. J. Buerger. March 1973. 32 pages.

N73—22332

Experimental investigation has shown that polarization of reflected sunlight is a sensitive technique for remote detection of soil surface moisture. The method seems reasonably invariant to the partial shadowing of a rough surface or to average inclination to the solar rays. Bare soils in two southwestern US agricultural areas were studied from an altitude of 2000 feet using a photopolarimeter installed in an aircraft. Soil specimens taken from the observed fields provided data on moisture content to be correlated with the polarization data. The results indicate the feasibility of measuring soil surface moisture by airborne polarimeter instrumentation. The instrumentation and methods of data reduction are described. Scatter in ground truth data is also noted.

### Analysis of Remote Sensing Data for Evaluating Vegetation Resources

University of California, Forestry Remote Sensing Laboratory. September 1970. 175 pages.

N73—22336

This report, one of a five-report series dealing with applying remote sensing techniques to forest, agricultural, and range management, discusses the use of photography and related imagery obtained from aircraft or spacecraft. Reference is made to such phases as operational feasibility, the spectral reflectance of natural surfaces, image enhancement and interpretation, automatic image classification and data processing, and training programs for taking inventories of vegetation resources. The work discussed centers around aids to multiple-use

management, determination of information transfer at various image-resolution levels and altitudes for wildland areas, and finding the value of small scale, multiband, multirate photography for analyzing vegetation. Instrumentation and analysis are described.

### Multistage, Multiseasonal, and Multiband Imagery to Identify and Qualify Nonforest Vegetation Resources

University of California, Forestry Remote Sensing Laboratory. Richard S. Driscoll and Richard E. Francis. September 1970. 70 pages.

N73—22338

This is a progress report on assessing the merits of using space and supporting aircraft photography for the interpretation and analysis of shrubbery and herbaceous native vegetation. The research includes the development of a multiple-sampling technique, and study of types of aerial film, scale, and seasons of photographing for identification and quantity measures. Identification results are described for types of plants and standing crops, and a number of photographs, statistical tables, and graphics are included. Image characteristics are also discussed.

### The Use of Space and High-Altitude Aerial Photography to Classify Forest Land and to Detect Forest Disturbances

University of California, Forestry Remote Sensing Laboratory. R. C. Aldrich, W. J. Greentree, et al. September 1970. 40 pages.

N73—22339

The report is one in a series covering an investigation begun in 1969 to explore the possibilities of developing predictors for forest land and stand condition using space photography. It has been found that infrared color film is a promising single multiband sensor for this purpose. Using Apollo 9 infrared frames, photointerpreters have been able to predict forest area for small units consistently within 5% to 10% of ground truth. It would appear that forest areas cannot be separated from other land uses optimally by means of optical film density alone, and the report presents possibilities that may be offered by introducing red, green, and blue cutoff filters. Test equipment, instrumentation, and research methodology are described.

### Potentially Efficient Forest and Range Applications of Remote Sensing Earth Orbital Space Craft—Circa 1980

University of California, Forestry Remote Sensing Laboratory. Richard C. Wilson. January 1970. 202 pages.

N73—22340

A relatively recent development in gathering data on world surface characteristics is the use of remote sensing



from earth orbiting space vehicles. The present document discusses 16 applications of remote sensing judged to be most important in the forestry, agriculture, and range disciplines. These are major land classification, timber inventory, range survey, fire forecasting, snowfield monitoring, detailed land classification, wildlife habitat, recreation resources, vegetation stress detection, air pollution monitoring, water cycles, erosion study, damage evaluation, large management unit monitoring, wildfire detection, fire mapping, and wildlife and livestock monitoring. It is expected that by 1980 some of these will be highly useful, others moderately so, others may contribute only limited data, whereas a few may be poor in results because of technical or scheduling difficulties. All these are covered in considerable detail, and some implications are given, including application to insect pest control.

### **Remote Sensing Application in Forestry**

University of California, Forestry Remote Sensing Laboratory; and Oregon State University, Department of Range Management. Charles E. Poulton, James R. Johnson and David A. Mouat. September 1970. 38 pages.

**N73-22342**

As part of a concentrated effort to use space and high-flight photography in furthering the progress of developing region, a test investigation has been conducted in a selected study area in Arizona. A low intensity study of vegetation and land form was made in Maricopa County using three frames taken in the Apollo 9 spacecraft. An intermediate intensity study derives from a photomosaic base created in high-flight photography. Some attention has been paid to land uses that result in alteration of the natural vegetation. Attention is called also to the ecological relation of macrorelief features to specific kinds of vegetation, so that photo identification of macrorelief classes is often a prerequisite for maximum exploitation of small-scale photography when vegetation resource analysis is the principal objective. Maps designated as ground-truth maps are discussed. Such remote sensing is expected to have increasing importance in forestry, agriculture, and rangeland management.

### **Remote Sensing Applications for Transportation and Traffic Engineering Studies: A Review of the Literature**

Mississippi State University, Department of Civil Engineering. James W. Epps. June 1973. 69 pages.

**N73-29989**

A survey is presented of the literature concerning the application of photographic techniques to transportation and traffic engineering studies. The survey is designed to illustrate the possible applications of remote sensing techniques to the solution of the same problems that

have been analyzed in the past using ground and aerial time-lapse photography and sequential aerial photography. The first part of the survey contains nine sections that give brief descriptions of the literature concerned with particular topics that offer the possibility of solution by remote sensing techniques. These sections are as follows: General remote sensing technology; urban transportation studies; vehicle placement and vehicle characteristics studies; traffic operations studies; interchange design studies; freeway ramp design studies; at-grade intersection design studies; highway planning studies and parking and pedestrian studies. The final section of the survey is comprised of a bibliography, with abstracts of the references included within the investigation.

### **Glossary of Aerial Photography and Remote Sensing in Geology and Earth Sciences**

Academy of Scientific Research and Technology (Egypt) and National Science Foundation (USA). Ibrahim A. El-Kassas and Mohamed A. El-Ghawaby. February 1973. 95 pages.

**PB-220 154**

This glossary is intended to fulfill the need to have standard definitions for the main scientific terms commonly used in aerial photography and remote sensing. Establishing standard definitions would encourage a uniform understanding among the scientific community and those who are interested in the applications of their techniques in geology and other earth sciences. The glossary includes definitions of 470 English-language terms that are commonly used by photogeologists and by interpreters of remote sensing data and aerial photographs. A list of source books and other reference sources is included to provide a source of more detailed explanations and further readings.



## **SOCIAL SCIENCES**

### **Area Handbook for Ecuador**

American University. Thomas E. Weil, Jan Knippers Black, et al. 1973. 413 pages.

AD-759 473

This handbook is intended to provide a convenient compilation of basic facts about the social, economic, political, and military institutions and practices of the Republic of Ecuador, as they existed in mid-1972. Some of the subjects covered are as follows: General character of the society; historical setting; geography and population; ethnic groups and languages; social system; education; living conditions; cultural life; mass communication; government system; political dynamics, values, and attitudes; foreign relations; character and structure of the economy; agriculture and industry; trade and transportation; public order and internal security; the armed forces. An extensive bibliography and an index are included.

### **Area Handbook for Laos**

American University. Donald P. Whitaker, Helen A. Farth, et al. 1972. 346 pages.

AD-761 012

This handbook is intended to provide a convenient compilation of basic facts about the social, economic, political, and military institutions and practices of the Kingdom of Laos, as they existed in mid-1971. Information is included on the areas controlled by both the Royal Lao Government and the Lao Patriotic Front where available. Some of the subjects covered are: General character of the society; physical environment and population; historical setting; social systems; health, education, and welfare; religion; languages; communication; the arts; political systems and values; political dynamics; foreign relations; character and structure of the economy; economic resources (agriculture, labor, industry); trade and transportation; national defense and internal security. A bibliography and a subject index are included.

### **East and Southeast Asia: A Bibliography**

University of Wisconsin, Land Tenure Center. March 1971. 90 pages.

B-219 331

The bibliography contains materials on agriculture, youth development and education, economic development and planning, rural conditions; capital, banking, and credit; land tenure and reform, Interasian relations, sociometrics and social change, resource management, food control, communes, and politics. References are to China, Hong Kong, Japan, the Koreas, Mongolia, Macao, and Taiwan in East Asia. References are to Burma,

Cambodia, Indonesia, Laos, Malaysia, Oceania, Philippines, Singapore, Thailand and the Vietnams in Southeast Asia.

### **Near East and South Asia: A Bibliography**

University of Wisconsin, Land Tenure Center. January 1971. 76 pages.

PB-219 344

This bibliography on economic and social development in the Near East and South Asia contains materials on land reform and tenure, labor relations, oil production, cultural and tribal characteristics, arid land planning and irrigation government policies, social change, and mobility nationalism, agriculture and farming military organizations, economic theory and trends, urban growth, international relations and cooperation, rural urban relationships, national attitudes, regional planning, animal husbandry, cooperatives, taxes, water resource management, personnel development and training, technological changes, ecology and environment, financing and credit, political systems, industrial relations, education, economic trends, food production, mechanization, foreign policy, innovation, family planning, export import characteristics, community development and allied topics.

### **Peru, Land and People: A Bibliography**

University of Wisconsin, Land Tenure Center. June 1971. 75 pages.

PB-219 486

The bibliography contains materials on regional development in Peru, agrarian reform, agricultural economics, cooperatives, fishing, land tenure, peasant organizations, water law and use, credit, finance, taxation, foreign aid, investments, industry, labor, natural resources, domestic and foreign trade, transportation, communication, Aprismo politics, military government, demography, education, Indians, urbanization, and allied subjects.

### **Communication for Change with the Rural Disadvantaged: A Workshop**

National Research Council, Agricultural Board. February 1972. 121 pages.

PB-224 401

Increasing attention is being given to cross-cultural communication on a global level. One aspect of cross-cultural communication involves the interaction between government and other agencies and the rural poor. Very often programs designed to serve the rural poor fail to reach any significant portion of the intended beneficiaries; the communication problem may be an important factor in this failure. This document contains papers, and discussions of those papers, presented at a workshop convened

to consider obstacles to effective communication between the rural poor and those who work with them. The topics covered include: Nature of the communication process; talking with the poor; goals in communication with the poor; difficulties faced in achieving the goals; some characteristics of organizations that affect two-way communication; characteristics of the disadvantaged as they affect communication; why communication is difficult; methods of successful communication with the disadvantaged; why methods fail. (Note: Paper copy available only from: Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20418; price \$3.75. Microfiche copy is available from NTIS).

### **The Quality of Life Concept: A Potential New Tool for Decisionmakers**

Booz-Allen Public Administration Services, Inc., and Environmental Protection Agency, Environmental Studies Division. March 1973. 396 pages.

**PB-225 089**

The concept of Quality of Life (QOL) has emerged in the last few years as an undefinable measure of society's determination and desire to improve or at least not permit a further degradation of its condition. Governmental decisionmakers regularly are establishing policy and programs, and allocating resources, in ways that significantly affect the quality of life of different groups of people in different ways. This document is the result of a symposium convened in August 1972 to explore the QOL concept, explore its component parts, and develop suggested quantitative approaches to its use in guiding public policy. The results of the symposium and an elaboration of the issues raised at that time are contained in the first section of this document. The topics covered include: Overview of the QOL concept; quality perspectives of varying life styles; approaches of different disciplines; quantification of QOL. The second section of the document is an anthology of readings assembled to give some background perspectives for the general reader. The 19 articles included cover the general areas: The state-of-the-art in defining QOL measures; overview of the QOL concept; environmental perspectives; economic and social perspectives; psychological perspectives; and attempts at comparative statistics.

### **Ability Testing in Developing Countries: A Handbook of Principles and Techniques**

American Institutes for Research. Paul A. Schwarz and Robert E. Krug. 1972. 263 pages.

**PB-226 015**

The handbook is based on an eight year program of research and development aimed at devising techniques of aptitude testing that can be applied in cultures where standard ability tests are not fully effective. These techniques are then investigated for application to human resource programs in the developing countries. The handbook is divided into chapters on the following topics: The importance of cultural factors in testing; testing reform as an investment; developing tests according to the abilities to be measured; the design of suitable tests; the design of effective testing procedures; descriptions of 19 ability tests from the I-D Aptitude Series; development of operational testing procedures; feasibility of a centralized institution for testing; organization and operating procedures of an institutional development program.



# TECHNOLOGY TRANSFER & RESEARCH MANAGEMENT

## Economic Impact of Stimulated Technological Activity. Summary Volume

Midwest Research Institute. November 1971. 48 pages.

N73-20977

This document highlights the findings of a research inquiry into the relationships between technological progress and economic development, with emphasis on ways in which research sponsored by the National Aeronautics and Space Administration (NASA) has aided in the accumulation and commercial application of new or improved scientific and technological knowledge. The first part is an examination of the importance of technological progress in the generation of national economic growth. The second part is a case study whereby technology is developed and commercially applied. The final part is intended to illustrate ways in which a NASA undertaking generated or improved knowledge which was added to the reservoir which is drawn upon and extended by any move toward application.

## NASA Patent Abstract Bibliography

N73-25976 Section 1, Abstracts. 133 pages.

N73-25977 Section 2, Indexes. 400 pages.

National Aeronautics and Space Administration, Scientific and Technical Information Office. January 1973. Many inventions result each year from the aeronautical and space research supported by NASA. The inventions having important use in government programs or significant commercial potential are usually patented by NASA. These inventions cover practically all fields of technology and include many that have useful and valuable commercial application. Section 1 of this bibliography contains comprehensive abstracts of 320 patents. Each entry is accompanied by a key illustration of the invention. Section 2 is comprised of indexes to 2353 NASA patents and patent applications covering the period May 1969 through December 1972. Many of the patents are available for licensing. (See also N72-29969 and N72-29970 in AMTID July 1973, page 139; and N73-24947 in AMTID November 1973, page 86.)

## Annotated Bibliography on Performance Evaluation for Research and Development

Johns Hopkins University, Applied Physics Laboratory. Gertrude S. McMurray. May 1973. 47 pages.

PB-224 320

The documents included in the bibliography were selected as pertinent to performance measurement of re-

search and development (R&D). Some provide understanding of how R&D is performed and managed; others deal with problems of selecting most likely to succeed projects and identifying and assigning values of outputs which lead to further projects. Special note is made of projects without financial profit motive in addition to those where the motivation is financial. Examples are given of economic benefits for industrial R&D, based on mathematical techniques, such as for chemicals, petroleum, and pharmaceuticals. A few of the topics of interest are technological forecasting, resource management, computer based information systems, efficiency measurement, innovations, economic and social factors, inventions, intellectual factors, symposia, aeronautical research, biomedical research government organizations, and military research. Most of the entries in the bibliography are accompanied by an abstract.

## Science, Policy, and the Utilization of Social Technology

Ohio State University Research Foundation. Philip M. Burgess and Louis D. Higgs. September 1971. 37 pages.

PB-224 497

The reported work is connected with a project on indicator systems for planning and decision in Puerto Rico. It deals with problems of social innovation in developing technology that uses and applies the best social science as a tool in policy making. It discusses the prototype planning and decision information system developed as part of PRIDE, the Puerto Rico Information and Decision Environment, in the framework of social science and public policy, and in the need for knowledge utilization models of knowledge-to-action processes. It proposes a two component social knowledge utilization system consisting of a multidisciplinary research and development laboratory and a social applications clinic, linked by a set of joint functions integrating knowledge and action, with a routinized interchange of personnel to forge a systematic socialization process between knowledge producers and knowledge users. The goal is crime reduction, elimination of disorder, and creation of greater economic equality.

## Technology Transfer, Institutional Transfer, and Induced Technical and Institutional Change in Agricultural Development

University of Minnesota, Economic Development Center. Vernon W. Ruttan. June 1973. 51 pages.

PB-225 804

The design of a successful agricultural development strategy involves a unique combination of technical and institutional change. It involves technical innovations capable of generating substantial new income flows. It also involves an adaptive response on the part of cultural, political, and economic institutions to realize the growth potential opened up by the new technical oppor-



tunities. An attempt is made to show how the addition of an induced innovation perspective can enrich our understanding of the process of technology transfer in agricultural development. An effort is also made to extend the induced innovation perspective to the process of institutional transfer.

### **Policies for the Application of Science and Technology to Development**

Cornell University, Program on Policies for Science and Technology in Developing Nations. October 1973. 105 pages.

**PB-226 279**

An interdisciplinary program devoted to the science and technology policies of developing nations seeks to identify and evaluate those policies which at both national and regional levels will promote social and economic progress. A position of neutrality on policy issues is maintained in order to safeguard the intellectual freedom of the individuals associated with the program. The report covers four symposium papers discussing policy problems which offer a promise of fruitful cooperation between the US and countries of the less-developed world. The areas concerned do not fall within the traditional fields of agriculture, population, and health; they involve technical assistance in scientific and technological advancement. The first deals with institutions and processes; the others are concerned with applications and programs. Titles are as follows: Science policy as an organizing principle for government action; Natural resources, development, and international aid; Orientation to development of science and engineering education in Colombia; Transfer and adaptation of technology in the construction industry.

### **International Development Programs of the Office of the Foreign Secretary**

National Academy of Sciences, Board on Science and Technology for International Development. Harrison Brown and Theresa Tellez. October 1973. 75 pages.

**PB-230 543**

In applying science and technology to the problems of economic and social progress in developing countries, the primary objective is to combine US efforts with those of corresponding agencies overseas. Assumptions of such an international effort is that scientific and technological growth is essential to national development, that indigenous scientific capabilities and competence are requisites for a nation to lessen its dependence on others, and that science can be specifically addressed to the problems of hunger, disease, and inadequate resources in the poorer lands. The report is a history of events and an analysis of results of joint programs between the National Academy of Sciences and counterpart groups in developing countries during 1959 to 1971. Broad topics of discussion are regional activities, bilateral programs, institutional relationships, workshop assessments, policymaking, advanced training and research, local government attitudes, local leadership, communications, guidelines, and recommendations.

## TEST METHODS

### Thermal and Mechanical Analysis of Welded Structures

Cornell University, Division of Engineering. Robert E. Rickell and H. David Hibbitt. August 1973. 37 pages.

D-771 946

Prediction of the residual state of stress and deformation in welded structures is a necessary but complex problem in structural mechanics. A wide spectrum of mechanical and thermal characteristics, various economic factors, important safety considerations, and nonlinearity in any analytical models all combine to provide the complexity. An approach to the problem involves the use of stress analysis as a straight-forward, general purpose, nonlinear, finite element treatment. The report discusses a few special features of such analyses, including the legitimacy of time dependent plasticity theories for treating residual stress, criteria for choosing plane or three-dimensional stress or strain models, methods for coping with possible floating solid regions during cooling, and the use of linear constraints in dealing with weld metal position and intermittent contact. Particular reference is made to large scale structures such as bridges, ships, pressure vessels, buildings, or other complex configurations.

### The State-of-the-Art of Nondestructive Testing of Tires

Army Materials and Mechanics Research Center. Paul E. Vogel. October 1973. 36 pages.

D-774 188

This survey is intended to provide in one ready reference summary of the state-of-the-art of the nondestructive testing of tires. The purpose is to furnish a guidance for the procurement, testing, and rebuilding activities; and also to avoid unnecessary duplication of developmental work on nondestructive testing techniques. The nondestructive methods covered include those involving the detection of foreign vapors, eddy current testing, speckle pattern recording, infrared emissions, holography, ultrasonic inspection, and x-ray inspection.

### Review of Fracture Toughness Methods

University of California, Lawrence Livermore Laboratory. Manuel E. Prado. April 1973. 22 pages.

CRL-51380

Fracture analysis was introduced into fracture mechanics as the result of structural failures in some of the cargo

ships built in large quantities during World War 2. Several methods for evaluation of material toughness have evolved, one of the most important being the Charpy V-notch specimen test. Because of limitations of this test, the fracture safe concept was developed, based on the generation of an energy curve from tests similar to the Charpy method. By such tests a transition temperature can be established for a material plate thickness. The report is addressed to a broad engineering audience, focusing on the areas of fracture-safe design and linear fracture mechanics. It is intended to clarify the relationship between these two approaches to toughness evaluation, and to explain the mechanics and tests used. A discussion is made of test applicability interpretation, and validity.



## TRANSPORTATION

### Strategy for Mobility

Brookings Institution, Transport Research Program. Wilfred Owen. July 1964. 261 pages.

PB-219 573

The present revolution in transportation has made clear a relation between poverty and lack of mobility. While jet planes speed travelers across continents, cumbersome methods of getting things moved dissipate enormous energies in vast underdeveloped areas of the world. The report considers the questions of how transport influences development, how a nation can determine its transport needs, what are the best kinds of transport for a particular region, how should they be financed and administered, what role can foreign assistance play, and how can even minimum standards be achieved in transportation to raise the level of living in low-step income countries. Some proposals are made for a better transport strategy on the part of developed countries in international cooperation in the interest of progress of the newer nations.

### Special Bibliography: Safety-Related Technology

National Research Council, Railroad Research Information Service. March 1973. 349 pages.

PB-220 220

More than 1900 abstracts of journal articles and research reports are given on railroad technology, primarily in the subject areas of track structure, track-train dynamics, vehicles, and rail components. Some of the particular topics in the bibliography involve high-speed trains, track welding, joint stresses, soil stabilization, slope failure, corrosion fatigue, innovative structures, test methods, use of plastics, rail shelling, inspection facilities, switch safety, riding quality, and snow-frost-ice engineering. Other materials deal with wheel-flat effects, mathematical models, harmonic roll, diesel-driver training, side thrust, computer studies, car-body engineering, bearing design, couplings, wheel mechanics, and axle design. Further subjects of interest include comparisons of various propulsion systems, locomotive construction, gas-turbine design, nuclear power, overpowered systems, braking considerations, environmental protection, derailments, freight operations, and logistics.

### Transit Passenger Shelters: Basic Design Principles

Virginia Polytechnic Institute. F. F. Ehrenthal, M. C. Cunningham, et al. January 1973. 60 pages.

PB-220 303

This report considers the problems involved in the design of streetside shelters for bus, trolley car, or other public transit passengers in urban areas. The objective of such design efforts is assumed to be the maximization of user welfare while optimizing environmental fit and cost. Each element of welfare (comfort, safety, convenience) is considered in the light of the constraints imposed by fit and cost. This analysis is used to develop a list of design criteria for shelters. A prototype shelter design, incorporating these criteria, is described in detail. Other problems confronting shelter designers are also discussed and some shelters in current use are described.

### Mass Transit Management: A Handbook for Small Cities

Indiana University, Institute for Urban Transportation. February 1971. 318 pages.

PB-222 386

The document is intended as a reference volume on the management of mass transit in smaller cities, particularly those with a population of 150,000 or fewer. Such smaller cities are frequently rather isolated and therefore cut off from the experienced transit managers of large metropolitan areas. Two major constraints are the amount of money available and the degree of specialization possible with limited manpower. Practices of small transit systems in the US were investigated to discover some of the methods and problems involved. The best methods observed are recorded, and ways in which improvements might be made on existing management and conventional practices are noted. Public and private ownership is discussed with especial regard to quality consumer service. The report is directed toward public officials and private citizens as well as transit managers. A means of correcting and updating some obsolete information is also given. A few of the topics included are gaining public interest, management functions, data collection and information systems, personnel selection and training, labor relations, maintenance, equipment selection for esthetics and comfort as well as marketing, routing and scheduling, communication and control, fare collection, advertising, and community relations.



## **Transportation and the Prospects for Improved Efficiency**

National Academy of Engineering. July 1973. 268 pages.

**PB-224 429**

This report is comprised of the proceedings of a symposium, held during October 1972, that was aimed at improving understanding with regard to urban transportation, the various interfaces involved, and barriers to progress. The proceedings present the views of experts from government, industry, and the academic community in identifying problems, relating transportation to urban development and renewal, and studying constraints. Topics of papers include the use of VSTOL aircraft for pickup and distribution, deep-draft ports for maritime freight movement, people and goods movers, telecommunication systems, new technologies, community building, urban-development concepts, and institutional frustration cases.

## **Energy Research and Development Opportunities for Heavy-Duty Transportation**

Federal Council for Science and Technology. July 1972. 50 pages.

**PB-224 883**

The scope of heavy-duty transportation relates generally to systems greater than 300 horsepower and includes air, sea, and land conveyances but excludes trucks and buses, which are considered light-duty transport vehicles. The report covers a study conducted to determine where opportunities exist to substantially reduce future energy requirements and fossil fuel dependence. A critical situation is nearing, since it has been estimated that in the next 50 years 80% of the world's oil reserves will be exhausted. Alternates must therefore be found to petroleum-derived fuels by the end of this century. A pivotal issue is the extent to which the air cargo mode, particularly by air cushion propulsion, can displace traditional and greater energy-consuming modes of shipment. Some of the topics discussed are the perturbed energy model, advanced subsonic and large long haul transport, advanced supersonic transport, air cushion research and development, nuclear ships, new engines using the open top Brayton cycle, and the closed cycle Brayton, the stirling, and the Feher designs; lighter than air vehicles, and large nuclear vehicles. Recommendations are made in all these fields.

## **Distance and Development: Transport and Communications in India**

Brookings Institution, Transport Research Program. Wilfred Owen. 1968. 188 pages.

**PB-225 962**

Inhabited by nearly one sixth of the world's population, India accounts for only 2% of the world's railway freight transport and only 1% of the world's truck and bus transport. Thus the development of India's transportation and communications systems, with their potentially critical role in combatting the nation's economic and social problems, is of major importance. The book identifies some of India's transport needs in the near future, including improved roads, modernized rail and truck systems, expanded air transport, and extension of telecommunications for education and technical assistance. Of special concern is the way in which distances affect development in India. Discussions are presented of inadequacies, policies, traffic patterns, targets, rural affairs, financing, urbanization, project planning, and foreign considerations. Considerable statistical data are presented. Stress is laid on the alleviation of a tremendous poverty burden.

## **Railroad Research Bulletin: Developmental Issue, Autumn 1973**

National Research Council, Railroad Research Information Service. 1973. 374 pages.

**PB-226 784**

The document contains 1297 abstracts of journal articles and research reports selected from the current railroad literature, as well as 150 summaries of ongoing research activities in the railroad field. The material covers the entire field of railroading, from technology to management, economics, government regulation, and operations. A few of the specific topics discussed are rights of way, tracks, train-track dynamics, vehicles and components, propulsion and braking systems, signals, control and communication, human factors, grade crossings, environmental protection, safety, freight and passenger operations, and advanced systems.

## WASTE PROCESSING & MATERIALS RECOVERY

### Sanitary Landfill

Construction Engineering Research Laboratory. D. L. Nelson. January 1974. 35 pages.

AD-773 714

The study has the objective of providing detailed information for the engineering design and the proper operation of a sanitary landfill. The report is an indication of the state of the art in two major categories: (1) operations, including basic methods, compaction procedures, expected refuse densities, cover requirements, and site improvements, and (2) design including refuse decontamination, production and control of leachate, and gas control. Information on hydrology, geology, climatology, and waste characteristics is used for evaluating and classifying sites. The report also enumerates possible uses for a completed landfill site, along with information on equipment requirements and landfilling costs. Nothing was available on conserving cover material by optimizing cell shape or size. However, mathematical analysis is useful in defining optimum cell shape and size, and minimum cover conditions in terms of the physical parameters of a landfill. Some advantages and disadvantages are also noted.

### Pyrolysis of Solid Waste: A Technical and Economic Assessment

Stanford Research Institute. S. B. Alpert, F. A. Ferguson, et al. September 1972. 81 pages.

PB-218 231

A promising development in the use of municipal organic wastes is pyrolyzing, or heating in the absence of oxygen, to produce combustible gases that may be used as fuel. The total refuse as received is processed by means of shredding, organic-from-inorganic separation, and drying of the organic fraction. The useful pyrolyzation product is a mixture of carbon monoxide, hydrogen, methane, and other gaseous hydrocarbons amounting to about 34% of the input, plus 16% carbon dioxide, 42% ash, and minor quantities of char and liquids. The char and liquids are returned to the combustion reactor to provide more heat, the heat being transferred by means of circulating sand. The report discusses two pyrolysis processes, one a single-reactor system, the other a two-reactor system, and outlines some of the economic and technical factors connected with each. It is concluded that there are incentives to encourage the commercial development of such a process, and recommendations are made for further development. Description of the laboratory investigation conducted is followed by a consideration of costs.

### Studies on Modifications of Solid Industrial Wastes

Syracuse University, Department of Civil Engineering. C. S. Grove and C. M. Antoni. 1973. 179 pages.

PB-222 419

This document is comprised of eleven individual papers that were prepared as a result of a 29-month study on the rehabilitation, reclamation, and resource recovery aspects of industrial solid wastes. The topics covered are the following: Collection and analysis of data on solid industrial wastes; summary of the physical properties of Solvay-process industrial waste bed materials; rehabilitation of solid industrial waste disposal sites; rehabilitation of Solvay-process waste beds; survey review of the scope, quality, and quantity of industrial solid wastes; increasing the rate of drainage through Solvay beds to increase the rate of soluble materials leaching; review of the literature, practices, and other aspects of solid waste and its management; modification of Solvay-process solid waste disposal; inhibition of acid mine drainage by municipal solid waste effluents; use of solid industrial wastes in the preparation of construction materials; effect of humus matter on retention of nitrogen fertilizers in soils.

### Design and Control of Incinerators: Vol. 1

Massachusetts Institute of Technology, Fuels Research Laboratory. A. F. Sarofim, G. C. Williams, et al. September 1973. 299 pages.

PB-223 626

Solid wastes generated in the five general areas of industries, agriculture, commerce, residences, and institutions amount to more than 15 million tons annually in the US alone. Disposal of this tremendous amount of refuse is a mounting problem as concern for environmental pollution increases. Three methods of disposal have traditionally been used: Open dumping, landfill, and incineration. Incineration has begun to offer some possibilities for recovery and recycling of some of these materials, but presently practiced methods are inefficient. In the search for improvement, a versatile batch incinerator was designed and constructed to determine the effect of operational variables on ignition and burning rates. This two-volume report covers investigation of a fuel bed designed to exhibit the conditions encountered in municipal incinerators. Volume one describes the detailed concentration and temperature profiles within and above the fuel bed that were obtained for different distributions of over- and underfire air rates. Characteristics of diffusion, drying, pyrolysis, and gasification were observed, and some conclusions are drawn that may aid in designing control features.



## **Design and Control of Incinerators: Vol. 2, Appendices**

Massachusetts Institute of Technology, Fuels Research Laboratory. A. F. Sarofim, G. C. Williams, et al. September 1973. 152 pages.

**PB-223 627**

Volume Two of a two-part report on investigations conducted in a test incinerator for solid waste disposal. Contains details of the apparatus and procedures used, and tabulations of the various data obtained. Schematics presented for the fuel bed and overfire sections. Furnace plate installation and calibration are discussed, followed by information on flow rates, compressibility corrections, and temperature vs. recorded voltage in the measuring system. Mathematical formulations are given for heat loss through the fuel-bed wall, the load cell weighing system, and discharge coefficients. Tables contain incinerator operating instructions. The Fortran program for data reduction is included.

## **Industrial Liquid Waste Surveys**

Environmental Protection Agency, Water Programs Operations. January 1973. 154 pages.

**PB-224 155**

As a result of manufacturing, every industry produces some kind and quantity of liquid-borne wastes. These may be detrimental to the quality of the receiving waters in many ways: toxicity, oxygen demands, sludge deposits, surface films, thermal effects, etc. This document is intended to serve as a training manual for engineers, chemists, and other professional personnel who will be responsible for planning and conducting industrial liquid waste surveys. It is also intended as a reference manual for anyone interested in the subject. The manual covers: liquid waste sources and pollution effects; industrial waste survey planning; specific analytical procedures; conducting the survey, including sampling, measurement, and source tracing techniques; and survey evaluation and reporting.

## **Design and Operation of Small Wastewater Treatment Facilities**

Environmental Protection Agency, Water Operations Program. Charles E. Sponagle (Ed.). April 1973. 117 pages.

**PB-224 266**

This document is intended as a training and reference manual for management and technical personnel responsible for upgrading wastewater discharge quality from communities of one hundred or fewer. The topics covered include: The freshwater environment; effects of pollution on aquatic life; water pollution by domestic wastes;

sources and effects of industrial wastes; wastewater treatment as the result of natural phenomena; chemical-physical processes; septic tanks; small treatment systems (package plants); advanced waste treatment plants for treatment of small waste flows; sewage lagoons; sewage lagoon operation and maintenance; general needs, reports, and control measures; control tests and sampling for operating wastewater treatment plants; sampling in water quality studies; operational inspections.

## **Bibliography on Ocean Waste Disposal**

Interstate Electronics Corp., Oceanics Division. May 1973. 111 pages.

**PB-224 452**

Efforts toward the development of criteria for the control of ocean waste disposal throughout the world and research on waste disposal in coastal waters revealed a critical need for documented information. To fill this need, the present bibliography was assembled. Four hundred citations are included, 74 of them with abstracts. Some of the subjects covered are biodegradable wastes, coastal zone management, dredge spoil, estuarine pollution, fish resources, mercury, ocean dumping economics, oil pollution, prohibited materials, ship waste disposal, sludge disposal, surface runoff, and wildlife conservations.

## **Recommended Methods of Reduction, Neutralization, Recovery, or Disposal of Hazardous Waste, Vol. 1: Summary Report**

TRW Systems Group. R. S. Ottinger, J. L. Blumenthal, et al. August 1973. 210 pages.

**PB-224 580**

The first volume of a 16 volume series presents a summary of the results of a detailed research project on hazardous wastes. It contains an updated listing of waste constituents, an evaluation of the adequacy of current waste management practices for those materials, and an identification of the research and development required to provide the necessary information or to devise satisfactory treatment methods. One clear indication obtained is a requirement for a system of national disposal sites. These would provide a repository for certain classes of hazardous waste stream constituent residues that must be stored and monitored permanently to avoid harm to the public or to the environment. Materials that are hazardous but not considered candidates for the national disposal sites are designated for industrial or municipal disposal sites. Individual reports that complete the series are listed below according to order number, volume number, and topic:

<b>PB-224 581</b>	<b>Vol. 2 Toxicology</b>
<b>PB-224 582</b>	<b>Vol. 3 Incineration and pyrolysis</b>



- PB-224 583 Vol. 4 Biological and miscellaneous processes
- PB-224 584 Vol. 5 Pesticides and cyanide compounds
- PB-224 585 Vol. 6 Mercury, arsenic, chromium, and cadmium compounds
- PB-224 586 Vol. 7 Propellants, explosives, and warfare materiel
- PB-224 587 Vol. 8 Miscellaneous inorganic and organic compounds
- PB-224 588 Vol. 8 Radioactive materials
- PB-224 589 Vol. 10 Organic compounds
- PB-224 590 Vol. 11 Organic compounds, continued
- PB-224 591 Vol. 12 Inorganic compounds
- PB-224 592 Vol. 13 Inorganic compounds, continued
- PB-224 593 Vol. 14 Waste origins, forms, and quantities
- PB-224 594 Vol. 15 Research and development plans
- PB-224 595 Vol. 16 References

### **Wastewater Treatment and Reuse by Land Application**

PB-225 940 Vol. 1—Summary. 95 pages.

PB-225 941 Vol. 2. 260 pages.

Metcalf and Eddy, Inc. C. E. Pound and R. W. Crites. August 1973.

The application of wastewater to land brings into play elements of climate, air, land, vegetation, and water so that understanding and analysis of its many aspects requires a multidisciplinary approach. Current knowledge on land application of municipal and industrial wastewater has been gathered and reported in these two volumes. Volume 1 summarizes the state-of-the-art for engineers, planners, managers, and decision makers. Detailed engineering information and supporting operational experiences are presented in volume 2. Coverage is limited to a presentation and discussion of only those methods of land application of wastewater that use the soil system to provide renovation of the water. Volume 1 includes sections on land application approaches, wastewater and site characteristics, system design and operation, environmental effects, public health considerations, and cost evaluations. Volume 2 covers irrigation with municipal wastewater, infiltration-percolation of municipal wastewater, land application of industrial wastewater, climatic constraints on land application, cost evaluation, and land application potential.

### **Site Planning and Potential Use for Sanitary Landfills**

University of Illinois, Department of Landscape Architecture. Robert W. Zolomij. June 1973. 94 pages.

PB-226 277

Legislation for environmental protection has resulted in the conversion of many junk dumps to sanitary landfills, but considerable suspicion prevails with regard to landfills. Whenever a new one is proposed, public objection usually arises, based on esthetic considerations as well as the increasing notion that all solid waste is a recoverable resource. Resource recovery methods are undergoing intensive development and research, but economies in general are not yet geared to assimilate the tremendous quantities of recovered materials that could be generated. For this reason sanitary landfills must be considered principal depositories for most solid wastes in the immediate future, plus the fact that even when resource recovery is practical there are unusable residues that must be disposed of. The report is directed toward alleviating the esthetic objections to sanitary landfills by examining the problem of making these a desirable part of the community. Innovative ways are offered, relating to appearance, dust, blowing refuse, traffic, and damage to roads by hauling trucks, and similar annoyances.

### **Economic Studies of Uses of the Glass Fractions from Municipal Incinerator Residues**

Bureau of Mines, College Park Metallurgy Research Center. Paul W. Johnson and James A. Barclay. 1973. 100 pages.

PB-226 703

Considerable activity is current in recovering the various mineral and metal values contained in municipal incinerator residues. Processes are in development for separating these residues into ferrous and nonferrous metal fractions and colored and colorless glass fractions. Studies of uses for the glass fractions have led to many possibilities in particular: bricks, floor tiles, glass wool, and glass beads. The last named involves producing microsized colorless spheres which have major use in reflective paints for highway striping. The report presents statistical data for the four possible utilities of recovered glass, including estimated capital costs, operating costs, product values, and interest rate of return on investment after taxes, along with equipment cost summaries for the bricks, tiles, glass wool, and spheres.

## **Sanitary Landfilling**

Environmental Protection Agency, Office of Solid Waste Management Programs. James E. Delaney. 1973. 196 pages.

**PB-227 056**

Proceedings are documented of a conference on sanitary landfilling held during November 1972. The primary objective was to provide an opportunity for open discussions and the exchange of ideas regarding sanitary land-considerations. Subjects discussed include: Selection of sites; site acquisitions methods; effects of industrial and hazardous wastes on site location; rural systems design; engineering and construction technology; climatic conditions; achieving maximum compaction. Other topics of importance were: Developing landfill programs; role of the state in land disposal; demonstration models; milled and baled refuse; rail haul; and land use policies.

## **Proceedings of the Joint Conference on Recycling Municipal Sludges and Effluents on Land**

National Association of State Universities and Land Grant Colleges; Environmental Protection Agency; and Department of Agriculture. July 1973. 253 pages.

**PB-227 106**

Municipal wastewater treatment is a major environmental problem involving both water pollution and air pollution. Treatment and disposal of the billions of gallons of municipal wastewater produced each day involve at least two primary difficulties: processing and economically utilizing the sludges generated, and removal of the polluting materials from the liquid effluents. Increased concern for water and air quality standards, along with regard for the tremendous expenditure of physical and financial resources for conventional wastewater treatment methods have prompted a search for alternative methods. One such method is known as the soils treatment systems, by which sludges are processed for use as fertilizers. The report contains the proceedings of a conference on this aspect of sludge and effluent recycling. Some of the topics of discussion are: demographic factors and application of wastewater, land acquisition for a sewage effluent disposal system, sludge properties, municipal effluent characteristics, effects on soil, toxic elements, soil-plant relationships, crop and food chain effects, sludge handling, economic aspects, institutional relations, and public relations.

## **Hospital Solid Waste: An Annotated Bibliography**

University of Minnesota, School of Public Health. Rexford D. Singer, Alain G. DuChene, and Nichole J. Vick. March 1974. 204 pages.

**PB-227 708**

Managers of hospitals and other medical care facilities are confronted with special problems in the handling and disposal of solid wastes. Extraordinary precautions are necessary to protect the patients, the working staff, and the public at large. The literature abstracted in this bibliography covers the period prior to 1973, concentrating mainly on that published after 1963. The 485 abstracts are arranged into four sections: generation of hospital solid waste, collection and transport, treatment and disposal, and general management. A subject index is included.

## **Social, Economic, Environmental, and Technical Factors Influencing Water Reuse**

Utah State University, Utah Water Research Laboratory. A. Bruce Bishop, Suravuth Pratishthananda, et al. December 1973. 46 pages.

**PB-228 146**

Water resources research planning has recognized that many factors enter into water salvage and reuse for obtaining a viable source of supply. To identify and interrelate such factors, a survey has been made of the literature and of current practices. The involved disciplines include technological, social, legal, economic, and environmental perspectives. The possibilities relate to municipal, industrial, and agricultural purposes in a given region. The report discusses such elements as background and need, municipal effluent and industrial effluent reuse, wastewater treatment processes, biological and disinfection processes, attitudes toward water reuse, environmental and health considerations, and technological and economic efficiency.



## **WATER SUPPLIES & HYDROLOGY**

### **Corrosion Resistant, Nonmetallic Water Well Systems**

Radian Corp. P. E. Hudson and F. W. Nobles. May 1973. 179 pages.

**AD-760 588**

Water-well installations are subject to premature failure owing to the rapid corrosion of metal casings, screens, and drop piping. In an effort to surmount this problem, a program was undertaken to test and evaluate plastic pipe reinforced with glass fiber for use in water-well systems. The resulting data, as presented in this report, are organized in a manner that will allow specifications to be prepared for a particular installation. The report is divided into two major sections. In the first, the data are presented in graphical form, and judgments are made of the effectiveness of glass fiber reinforced materials applied to water well systems. In addition, the equipment and methods needed to test the material are described. A relative cost analysis of a shallow well is made considering various types of, plastic pipe reinforced with glass fiber and common and stainless steel pipe. Examples of using the data to prepare specifications are also presented. The second section of the report contains the point-by-point data collected during the program.

### **Hydrologic Engineering Methods for Water Resources Development. Vol. 11: Water Quality Determinations**

Army Corps of Engineers, Hydrologic Engineering Center. Roy W. Hann, Jr. and R. G. Willey. July 1972. 145 pages.

**AD-762 109**

In the development of the world's water resources in the past half century, the quality of the water resource being developed has often been of minor concern. During recent years, however, the world's rapidly expanding population, the development of high-production agriculture practices, the development of industries, and a higher expectation in the quality of life have caused a reassessment of the role of quality in water resource development. This volume examines the technology of the water quality field as it applies to water resource planning in general and to the water problems of developing countries in the particular. Consideration is given to the physical, chemical, and biological parameters of water quality; water quality requirements for various beneficial uses; causes of water quality degradation; water quality calculations; water quality surveys and water

quality management. A listing is included for a generalized computer program that simulates the vertical distribution of water temperature within a reservoir on a monthly basis from data on initial conditions and inflow, outflow, evaporation, precipitation, radiation, and average air temperature. The program should be useful in determining the required number of intake levels, their vertical location, and for evaluating the thermal portion of the reservoir's environmental impact. (This volume may be used independently from others in the series. Volume 1, 2, and 10 are currently available; AMTID, November 1973, pages 115—116.)

### **Water Desalination: A DDC Bibliography**

Defense Documentation Center. January 1974. 85 pages.

**AD-773 250**

This bibliography contains abstracts of reports on water desalination. The reports include information on producing fresh water from saline water by means of solar energy, evaporators, distilling plants, and vacuum apparatus. The period covered is 1953 through late 1973. Subject and author indexes are included. The report is listed in the bibliography are available from NTIS. (This volume supersedes an earlier edition, AD-725 600, described in AMTID, April 1973, page 6.)

### **Worth of Hydrologic Data for Short-Term Forecasts of Floods**

University of Arizona, Department of Hydrology Water Resources. M. Sniedovich, C. C. Kisiel, et al. 1973. 100 pages.

**COM-73-11773**

In hydrology, the answer to the question of how much data is enough depends in part on the goals of the hydrological study, the hydrologic model to achieve the goal, and the number of variables to be estimated for the model. For the large scale environmental systems that exist in hydrology this is not a trivial problem. This document describes a methodology developed for the evaluation of the worth of hydrologic data for short-term forecasts of floods. A discussion of the forecasting systems and the hydrometric system in flood plain activities is followed by a description of a economic-sociologic model of the worth of hydrologic forecasts. An evaluation of the effectiveness of the forecasting system is presented; forecasting policy is discussed with respect to the type of the forecasting model and to the nature and the timing of the forecasts. Finally, the role of Bayes decision theory in determining forecasting policy is discussed.



### **Method for Treatment of Water Containing Low Concentrations of Mercury**

Wis Research Center (NASA). Dennis J. Flood and  
Rald J. Kraynik. March 1973. 7 pages.

3-20972

The purification of water containing trace amounts of mercury apparently has not, as yet, received much attention. It is conceivable, however, that in the future it may be necessary to produce large quantities of potable water from supplies contaminated by mercury concentrations in the order of a few micrograms per cubic centimeter. A treatment process will have to handle large volumes of water quickly, and must avoid the addition of other undesirable chemicals. This document describes a very simple treatment process that meets both criteria. Essentially, the process involves the circulation of mercury-contaminated water through a chamber containing coprecipitated nickel powder, where amalgamation of the mercury and copper occurs. Any grains of powder escaping from the chamber are trapped in a magnetic filter located downstream.

### **Investigation of Natural Sealing Effects in Irrigation Canals**

University of Idaho, Water Resources Research Institute.  
C. Brockway. June 1973. 40 pages.

221 010

The design of irrigation distribution systems or storage facilities, the installation of impermeable lining has been based on seepage rates of soil types plus limited field and laboratory tests. Estimates based on limited testing can be considerably in excess of the long term operating seepage rates. With the increasing demands on water supplies in irrigated areas, all means of reducing undesirable seepage losses are being sought, and particular attention is directed toward natural sealing phenomena. This document provides the results of a study that was undertaken to identify the role of three factors known to be active in the sealing of canals and reservoirs, to evaluate the expected magnitude of each effect on soils, and to derive guidelines for estimating the magnitude of sealing effect and long term operating seepage losses for future developments. The factors of interest are sealing layers or zones of low hydraulic conductivity that develop on channels due to siltation or soil pore clogging, chemical reactions between the soil and infiltrating waters, and the activity of micro-organisms in the surface layer of a soil.

### **Mathematical Modeling of Water Management Strategies in Urbanizing River Basins**

Colorado State University, Environmental Resources Center. Wynn R. Walker and Gaylord V. Skogerboe. June 1973. 127 pages.

PB-222 281

Regional urbanization introduces new problems in administering natural resources, such as water. Concentration of water use and growing demands create serious reductions in water quality, whereas management methods are not usually altered to cope with changing requirements. The situation is particularly serious in arid urbanizing regions. The report is concerned with the feasibility of alternative water management strategies in a dry area that may alleviate mounting water shortages and deteriorations. Mathematical models were formulated to study the interrelationships among various institutional factors to delineate requirements for optimal policies. Two study areas in the western United States were selected on which to test the utility of the models. Together the models produced results considered useful in determining optimal strategies. Important in the considerations are wastewater treatment and reclamation, agricultural water transfer, coordination of agricultural and urban water management, diking, and desalting. A computer program developed for the study is presented.

### **Vertical Tube Distillation Desalting State-of-the-Art**

Hittman Associates, Inc. Robert Blevitt and H. M. Curran. November 1972. 152 pages.

PB-224 277

The state-of-the-art design, performance, and economics of vertical tube evaporator (VTE) water desalting plants are analyzed and reviewed in this report. Both single- and dual-purpose plants varying in size from a million to 250 million-gallons-per-day capacity are considered. The functional aspects of VTE plants are described and the various process streams are discussed. This is followed by a detailed discussion of heat transfer, performance ratios, and other process parameters. Capital cost parameters are then covered, including estimation of evaporator components, intake/outfall structures, feed pretreatment equipment, piping, instruments and controls, and site and engineering costs. Various elements contributing to overall water costs are described, and the methodology for estimating costs of water using single-purpose steam driven water plants and dual-purpose steam-electric-water plants is described. Finally, an evaluation is made of potential advances in the state-of-the-art for VTE plants.

**Methodology for Assessing the Potential Impact of Urban Development on Urban Runoff and the Relative Efficiency of Runoff Control Alternatives**

Massachusetts Institute of Technology, Department of Civil Engineering. Guy Leclerc and John C. Schaake, Jr. March 1973. 258 pages.

**PB-224 477**

Storm runoff from urban or natural catchments is a multivariate process involving time and spacial distributions. Certain runoff characteristics such as peak rate at a given location are important to assessing performance of a hydrologic system. The report studies the relationships between urban development, drainage systems, and runoff, as well as measurement procedures in developing runoff control systems. The methodology uses runoff frequency curves, derived at different stages of development of the urban catchment. Comparisons of these curves provide quantification of urban development impact and efficiency of a particular control structure. The runoff frequency curves are derived from rainfall data. A rainfall model describes the rainfall exterior and interior, preserving the intensity-duration-frequency curves of the sample. A modular model of the catchment is developed with kinematic wave equations. Filter theory is used to estimate the parameters of an infiltration model from observations of rainfall and its runoff.

**Consolidation of Irrigation Systems, Phase 1: Engineering, Legal, and Sociological Constraints and/or Facilitators**

Colorado State University, Environmental Resources Center. Gaylord V. Skogerboe, George E. Radosevich, and Even C. Vlachos. June 1973. 443 pages.

**PB-225 289**

A study is made of the intricate relations between irrigation, population, urbanization, economics, interest groups, management, and the environment. Without irrigation, arid lands are practically useless to agriculture. When agriculture develops under irrigation, population grows and urbanization impact mounts. Competition increases between municipal, industrial, and agricultural uses, along with concern for pollution, floods, fish and wildlife, and esthetics. The report points out three major areas where careful planning is needed to meet the increased demands and yet protect the environment. These are physical and technological improvements to existing water systems, legal rearrangements to overcome oppositions and permit the streamlining of antiquated or traditional practices, and improvement in management and delivery practices in line with the social, political, and economic factors involved. One example of an irrigation system is presented schematically, and its sub systems are discussed with regard to policies, operating characteristics, and requirements. Attention is paid to attitudes and constraints as well as to hydrology.

**Algae Control in Water Supply Reservoirs**

Illinois Institute for Environmental Quality. C. B. Muchmore. July 1973. 33 pages.

**PB-226 275**

The most commonly used method of controlling excess algae in water bodies is through the use of copper sulfate. The potential toxicity of this compound prompted a review of the literature in an effort to find an alternative method for the control of algae in water supply reservoirs. The methods considered, and which are briefly summarized in this document, include: Nutrient control; biological control; water intake location; light exclusion; sound; and alternative algicides. It is concluded that none of these alternatives constitute a satisfactory substitute for copper sulfate treatment at the present time. Therefore, instructions for the proper application and dosage determination of copper sulfate are given. Consideration is given to the environmental effects of copper sulfate treatment, particularly its potential for accumulation in bottom sediments.

**A Social Report: Man and Water. The Relationship Between Social Psychological Systems and Water Resources Development**

Abt Associates Inc. Stephen J. Fitzsimmons and Ovadia A. Salama. November 1973, 448 pages.

**PB-226 544**

The sociopsychological relationships of man to water resources development are discussed in this document and preliminary measures are constructed to evaluate the social benefits and costs of water development to man. These measures are designed for integration with economic, environmental, and technical measures and with aggregation to regional and national levels. Several conceptual areas are identified from the literature in the fields of sociology and social psychology: the individual, the group, organization, social process, social maintenance and change, the society and population or demography. A similar review of water development literature identifies 14 water functions such as ecology, supply and energy recovery. The two groups of variables are arrayed with each other, and three types of interactions are considered: the social needs for water, water functions having positive social impacts, and water functions with negative social effects. A number of parameters in the interactions are identified, reviewed with respect to program and policy characteristics, and over 250 preliminary social measures are proposed. Recommendations are made regarding pilot testing of social measures, synthesis and aggregation of data, and future national actions. The material contained in this document provides a step toward meaningful social measurement, developed out of theory, research, and program experience.



### **Analysis, Modeling, and Forecasting of Stochastic Water-Quality Systems**

Kansas Water Resources Research Institute. E. Stanley Lee. July 1972. 282 pages.

**PB-226 566**

Estimating the response of a river or stream to any proposed pollution abatement action is one of the most complex problems facing the sanitary engineer. The mathematical models that must represent a complex blending of biological, chemical, and physical factors are not simple and must be represented by complex differential equations. In order to establish these equations, the reaction and diffusion constants must be estimated from actual experimental data. For a fairly complex system these equations cannot be solved analytically. Furthermore, the reaction, diffusion, and mixing constants cannot be measured directly. They must be calculated from the measured change of concentrations with respect to time or space. Thus, these constants or parameters must be estimated directly from the set of differential equations based on the experimental data. The modeling and forecasting of stream quality by time series analysis and spectral estimation are discussed in this report. The time series analysis is essentially a statistical approach. The principal advantage of this approach is that useful quantitative information can be abstracted from the original rough data that are collected during a long period of time. Furthermore, by the analysis of these rough data, useful mathematical representatives of the various pollution parameters can be obtained. These representations can be used for modeling and forecasting purposes.

### **Analysis, Modeling, and Forecasting of Stochastic Water Quality Systems. Vol. 2**

Kansas Water Resources Research Institute. E. S. Lee. August 1972. 224 pages.

**PB-226 567**

This second volume deals with nonlinear filtering and estimation in water quality modeling. The subject matter covered includes: Historical review of nonlinear estimation theory and its development; approximate nonlinear estimation algorithms; optimal weighing function—a search algorithm; parameter identification in an activated sludge process; optimal estimation of states and parameters in a nonlinear hydrologic system response model.

### **Minimum Cost Design of Water Distribution Systems**

University of Kentucky, Water Resources Research Institute. Don J. Wood and C. O. Charles. September 1973. 50 pages.

**PB-226 764**

Consideration is given in this paper to the development of analytical tools and procedures for designing water distribution systems at minimum costs. One promising technique is the use of analog simulation, along with linearization of basic nonlinear system equations. Combining this approach with digital methods produced digital programs for pressure and flow calculations which are more advantageous than conventional techniques. There is no need to balance the network initially, and convergence of the procedure is assured. Thus a procedure has evolved that would lead to a minimum-cost design within the prescribed constraints. The method of steepest ascent and concepts of dynamic programming are useful in optimization. The procedure applies to closed-loop systems without internal pumping, and gives a basis of extending the concepts to more generalized water distribution systems.

### **Manual for Calculation of Conventional Water-Treatment Costs**

Control Systems Research Inc. I. C. Watson. March 1972. 89 pages.

**PB-226 791**

The report provides the fundamentals for estimating the cost of conventional water treatment. The estimates include costs for coagulation, sedimentation, and filtration; softening by lime-soda; iron and manganese removal; activated carbon absorption; chlorination; defluoridation; and microstraining. Equipment and facilities are described, along with dosage calculations, plant cost estimates, and investment considerations.

### **The Generation of Flood Damage Time Sequences**

University of Kentucky, Water Resources Institute. John P. Breaden, 1973. 158 pages.

**PB-227 216**

There is need in water-resources planning to develop a procedure for determining the time pattern in which flood damages occur as a function of the rise and fall of the flood hydrograph. The widely used approach for estimation of flood damages fails to account for the fact that the frequency of the annual flood peak may differ from the frequency of the total annual flood damage. Thus several small storms in one year may do more



damage than a single larger one, although damage may be reduced by lessened flood duration rather than intensified by flood peaks. The report presents a digital computer subroutine that may be used to estimate the direct and indirect damages to crops, fields, urban areas and public facilities as function of the depth and duration of flooding, the seasons, and time lapse between flood events. It can be used to analyze the time pattern of damages in the flood plain for optimizing policies and for formulating alternative flood-control schemes.

### **Identification and Control of Pollution from Salt Water Intrusion**

Environmental Protection Agency, Office of Air and Water Programs. 1973. 100 pages.

**PB-227 229**

Degradation of the quality of fresh surface and ground waters by intrusion of saline water is a common and complex problem in coastal and inland areas. The problem is seldom a direct result of waste disposal but rather the inadvertent result of man's alteration of the environment, involving changes in land use, stream channel operations, and consumptive withdrawal of natural waters. Identification and evaluation of intrusion begins with understanding the general mechanisms by which it occurs. When coastal aquifers are overpumped or impeded, the ground water level is lowered and saline water can move into areas previously limited to fresh water. The problem is usually allied to urban and industrial development with its withdrawal and nonreturn of natural water. Assessment of salt water intrusion includes spatial delineation of primary aquifers and streams, analysis to establish trends, and monitoring of the fresh water-salt water interface. Sampling information includes location of areas by elevation; depth and velocity of streams, water-table depth, and temperatures. A rise in electrical conductivity is a reliable indication of increasing salinity. Hydrogeological investigation is needed on geologic structure of the water basin, soil and rock characteristics of subsurface formations, and the nature and possibilities for natural and artificial recharge. In regions of high water use, zero increase in salinity may not be maintainable, so monitoring becomes especially important.

### **The Optimal Expansion of a Water Resources System**

University of Texas, Department of Chemical Engineering. D. M. Himmelblau. August 1973. 137 pages.

**PB-227 335**

Because of the rising demand and limited supplies of water, decisionmakers all over the world are concerned with how to carry out an optimal expansion of their existing water resources systems. Whenever investment in a water project is considered, important questions of

economic value, optimal scale of development, and program timing need to be answered. The broad objective of the reported research is to develop strategy for expanding a complex deterministic water resources system. Certain linear and nonlinear programming techniques have been combined and modified to serve as tools for planning, designing, evaluating, and managing such systems. An efficient computer code was prepared to handle the required numerical calculations, plus detailed flow charts for the subroutines. Both are included in the report. In addition, a mathematical model was developed for river basin components that is compatible with the strategy. Application of the results to a typical river basin is included to illustrate the computations involved.

### **The Economics of Water Use**

Colorado State University. Debebe Worku. March 1973. 175 pages.

**PB-228 248**

Pakistan may rightly be regarded as a river-born nation; its history is closely knit with the development of irrigated agriculture. Water is the major critical factor in the patterns of agriculture, land productivity, and economic behavior of most Pakistani farm dwellers, and development of water resources has a primary role in the economic life of the entire nation. This document examines the problems of water supply, trends, and usage in Pakistan and economic conduct of Pakistani farmers with respect of their sensitivity to incentives in allocation of water resources. In general Pakistani farmers are observed to be quite sensitive to economic policies, responding readily to those having positive incentives, and reacting adversely when policies are deemed incorrect. The report concludes that the Pakistan government could largely change farmers' courses of action by manipulating the forces lying behind the market mechanisms.

## **WIRE & CABLE**

### **State-of-the-Art of Electromechanical Cables**

Naval Civil Engineering Laboratory. J. R. Padilla, M. C. Hirionaka, et al. August 1973. 77 pages.

**D-772 516**

A review is provided of the state-of-the-art of submersible ocean cables that contain electrical wiring and special strain members. The purpose is to define areas of deficiency in the technology of submarine electromechanical cable systems so that development programs might be strengthened. The approach included both a literature search and extensive interviews with manufacturers and users. Matters of interest are mechanical and electrical properties, hardware, manufacturing methods, developmental history, handling, termination and cable design, and maintenance and repair. Deficiencies are discussed in the last three categories as well as in specifications and testing. Failures experienced are not yet fully understood. Cost savings are seen as justifying improvement and further research in repair methods and maintenance procedures. A few specific topics of importance are corrosion, torque balancing, field splicing technology, synthetics for strength members, high power transmission, and connectors.

### **Proceedings of the Twenty-second International Wire and Cable Symposium**

Army Electronics Command. December 1973. 368 pages.

**D-772 914**

These proceedings contain 40 papers that were presented at a symposium, held in December 1973, concerned with recent developments in electric wire and cable research and engineering. The work of organizations in eight countries is represented. The general subject areas covered include the following: Stability of polyolefin materials; coaxial cables; multipair-cable design; new material developments; splicing and interconnections for communications; applications and field engineering; processes and manufacturing.

### **Flat Conductor Cable Symposium, October 10-12, 1972**

George C. Marshall Space Flight Center (NASA). James D. Hankins (Ed.). December 1972. 611 pages.

**N73-23294**

The report documents 24 papers and presentations on flat conductor cables. Materials cover connectors, termination techniques, electrical characteristics, and both aerospace and nonaerospace applications. Topics of discussion vary from why flat cable might be preferable to round, through design, materials, and thermal and electrical properties, to costs and advanced concepts in wiring. Uses for aircraft, homes, businesses and engineering are described.



## WOOD & PAPER

### Increasing Serviceability of Wood Pallets

Department of Agriculture, Forest Products Laboratory.  
R. K. Stern. 1973. 13 pages.

AD-773 429

The reusable portable castered wooden platform, or pallet, used for transporting equipment and materials in warehouses and elsewhere, is subject to damage by rough handling and fork-lift truck impacts. The report covers an investigation aimed at prolonging the service life, of wood pallets, including minor alterations to the pallet and to the powered hand-type forklift truck: nailed joints to replace mastic joints, recessing the leading edge deckboards from the ends of notched stringers, and adding an impact panel to the forks of the forklift truck. It would appear that handling severity may be reduced further by employing cushioning devices and techniques. The impact panel developed is of particular interest.

### Methods and Techniques for Veneer-Peeling Research

Canadian Forestry Service, Western Forest Products Laboratory. J. R. T. Hailey and W. V. Hancock. January 1973. 26 pages.

PB-220 325

Veneering is the overlaying of common wood with a thin layer of finer wood for the production of furniture or decorative articles. The production of veneer, termed veneer peeling, is discussed with regard to quality, dimensions, and sampling procedures. Veneer peel quality studies must provide adequate information on attributes for a given set of lathe, bolt, and location variables. The report deals with veneer thickness, roughness, depth, and moisture content. Statistical methods are described for sample size and analysis of variance to determine the variability encountered within a given study. A veneer-sampling plan and a peeler bolt sampling plan are selected to ensure statistically sound sampling procedures and to assist in maintaining uniformity of sampling procedure for study to study. Routine procedures are presented for measuring the pertinent qualities.

### Cracking in Round Timber: A Discussion about Causes with Special Reference to Impact

Commonwealth Scientific and Industrial Research Organization (Australia), Forest Products Laboratory. J. Barnacle. 1973. 14 pages.

PB-220 895

Separations or fractures in logs occurring during growth, tree felling, and drying cause much economic loss to the timber industry, and considerable effort is expended in attempts to control this loss. Little attention has been paid to the effects of impact in felling when the trunk and branches of trees strike the ground. This force acts with varying degrees of intensity on nearly every tree that is felled, and must be held responsible for reduction in quality of timber that is unshattered but internally damaged. The report examines the existing state of knowledge of damage from fracture in logs, and makes some suggestions regarding the characteristics of impact damage and its likely effect on subsequent degradation in the log and in the timber sawed from it. Conditions that could influence the development of cracks are discussed.

### Pulping of Tropical Hardwoods: Individual and Mixed Species, Wood and Paper Properties, Resource Assessment

Commonwealth Scientific and Industrial Research Organization (Australia), Forest Products Laboratory. H. Higgins, F. H. Phillips, et al. 1973. 24 pages.

PB-221 282

The report makes an assessment of the potential of tropical hardwoods for specific end uses in the paper industry, and discusses a number of associated problems. Three approaches to evaluation have been adopted: Pulping tests on a representative wood sample, tests on a simulated sample from the major species, and construction of a theoretical sample from measurements of basic density and pulping results on individual species. Mixed tropical hardwood kraft pulps are compared with established eucalypt pulps for alkali requirement, yield, initial freeness, and beating time. Concern about the heterogeneity of the pulpwood is focused mainly on pulping efficiency and ensuring a uniform pulpwood supply. The storage of mixed hardwood chips in outside piles in the tropics appears feasible, and mild biodeterioration apparent does not seriously affect the pulping, bleaching and papermaking qualities.



## **Quality Control in Veneer Drying and Plywood Gluing**

Canadian Forestry Service, Western Forest Products Laboratory. S. Chow, T. E. Troughton, et al. August 1973. 37 pages.

**B-226 223**

In the manufacture of exterior softwood plywood bonded with phenol formaldehyde glue, several process steps must be optimized to produce a high-quality product. These include veneer peeling including thickness and roughness control, drying including under- or overdrying, drying up with attention to grain and glue spread as well as time, pressing, finishing, and bond-quality testing. Measurement techniques are given for determining glue-line temperatures. The relationship of glue-line temperatures to degree of cure measurements made by a spectrophotometric method are given. Other cycle factors are discussed as well. The manual is concerned with all steps except veneer peeling and finishing.

## **Cost-Price: A Useful Way to Evaluate Timber Growing Alternatives**

Department of Agriculture, North Central Forest Experiment Station. Allen L. Lundgren. 1973. 17 pages.

**B-226 489**

Several ways are cited for looking at an investment: Will its income exceed its cost? What may be the rate of invested capital increase? What will be the return on each dollar put in? How long will it take to get back the invested capital? What will it cost to produce a unit of output? The report suggests several criteria for answering these questions: Net worth, present or future; internal rate of return; benefit cost ratio; payback period; and production cost per unit. Each will measure the investment in a different way, and all have a place in evaluating alternatives. The paper explains how to calculate and use cost-price as an investment criterion for timber and other forest products, cost-price being defined as the cost of producing one unit of output, expressed in dollars per cubic foot or some other convenient unit. Graphic illustrations are provided, and a mathematical model is developed and discussed.

## **Technological Opportunities for Tropical Forestry Development**

Agency for International Development, Office of Science and Technology. Gordon D. Fox. November 1973. 37 pages.

**B-229 813**

The ability of developing countries to absorb technological innovations in forestry varies considerably. This doc-

ument is intended to identify the most promising opportunities for the application of new technologies in the developing countries for sound management and utilization of forestry resources. It is a followup to a previous report entitled *Forestry in Developing Countries—Potential, Constraints, and Opportunities* (See PB-212 726 in AMTID, April 1973, page 113), and is a more detailed presentation of the situation by country. Criteria are developed for determining whether the political-socioeconomic framework in a country is sufficiently favorable so that technological inputs can have a meaningful impact on improving development and use of wood products and on improving forest management. Those developing countries where criteria appear to be adequate for such aid are identified. Finally, a limited number of these countries are examined to illustrate how specific technological inputs can be matched with priority needs, and likely payoffs are assessed.

## **Utilization of Tropical Forests (A Review of the Forestry Literature in the Agency for International Development Reference Center)**

Agency for International Development, Office of Science and Technology. Edward P. Cliff. November 1973. 31 pages.

**PB-229 822**

The tropical forests of the world comprise a large but underdeveloped natural resource. It is generally recognized that if these forests could be more completely and more efficiently used under sound conservation principles, they could make a far greater contribution than they are now making to the economic growth of tropical countries. This report provides a review of the literature generated by US AID-funded research on problems of use of the so-called secondary tree species in the developing countries. Particular attention is given to the identification of constraints preventing greater use of presently unused or underused species, and to possible ways of overcoming these constraints.

## **Factors Influencing the Utilization of Tropical Wood Species**

Department of Agriculture, Forest Service. A. D. Freas, M. Chudnoff, et al. November 1973. 34 pages.

**PB-230 738**

The Agency for International Development has been concerned with the fact that, in many tropical countries, tree harvesting activities concentrate on a relatively limited number of species. Such limited exploitation not only limits the resource base from which developing countries can enter into international commerce, but it also limits the possibilities of furnishing amenities to their own populations. Also, long-term dependence on a few "preferred" species has the potential for their eventual depletion or near depletion. This report provides the

results of a survey of the extent and significance of the current lack of knowledge of the properties of wood derived of secondary species of tropical woods which was undertaken to clarify whether lack of knowledge of secondary woods is a significant inhibitor to their utilization. The investigation involved both a review of the literature and consultation in selected countries (Philippines, Colombia, Ghana, and Nigeria). Some of the subject areas covered include: Supply and demand prospects; species use; factors influencing species selection; availability of technical and technological information; forestry institutions; forest inventories; heterogeneity of the forests; botanical knowledge; traditional preference within the producer countries and within their markets; industrial practices; forest management; government controls; marketing strategies; transportation; development of local processing industries, technology transfers.

### **Development of the Tropical Wood Resource**

Department of Agriculture, Forest Products Laboratory.  
Martin Chudnoff. November 1973. 76 pages.

#### **PB-231 006**

There is considerable concern about the possibility of a "knowledge gap" about the physical, mechanical, and other wood characteristics of the secondary species of heterogeneous tropical forest stands. A related concern is whether lack of knowledge significantly inhibits the use of secondary species. This document attempts to illuminate certain aspects of this concern by focusing on a few selected countries. These countries are: Colombia, Gabon, Malaysia, Nigeria, Peru, Philippines, and Surinam. All have the following attributes: An extensive forest reserve, actively export forest products, external and internal trade in a few species, a high volume of secondary species, at least a fair access to the forest reserve, and some capability for sawmilling, panel production, and manufacturing. For each country, a summary is given of information concerning the availability of forestry literature, classification of tree flora, species being harvested for domestic and foreign trade, efforts at forest enumeration, characteristics of primary species, forest yield and quantities that flow to domestic and foreign trade, and forest management.

### **Physical, Mechanical, and Other Properties of Selected Secondary Species Located in Surinam, Peru, Colombia, Nigeria, Gabon, Philippines, and Malaysia**

Department of Agriculture, Forest Products Laboratory.  
Martin Chudnoff. November 1973. 83 pages.

#### **PB-231 894**

This document provides a compilation of previously published information on the properties of the wood of secondary tree species growing in seven tropical countries. The species selected for review are well known in the source countries, but make up a very small component, if any, of their export trade. The following information is provided for each species, where available: Scientific name; common names in the various localities of range; geographic range; tree characteristics; color of wood; grain; weight; strength characteristics in green and cured states; drying; working properties; durability and preservation; uses; and sources of further information.

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# Application of Modern Technology to International Development

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## A Program for Sharing Technical Information

Almost from the beginning, the United States has been willing to share with other nations the scientific and technological information it has developed. For well over a century, such sharing has been encouraged in medicine and agriculture, and more recently, in nuclear energy and space technology.

About two and a half years ago, the U.S. Agency for International Development and the U.S. National Technical Information Service began an experimental program designed to make it easier for developing nations to more fully utilize the information produced by U.S. Government-sponsored research projects.

A major feature of the program was the publication and distribution of a new quarterly journal, *Application of Modern Technologies to International Development (AMTID)*. This journal carries abstracts of new research reports, available from NTIS, which should be of special interest to developing countries.

*AMTID* is fully supported by AID and is distributed free of charge. Complete documentation for the reports abstracted in the journal can be purchased from NTIS for the same price charged in the U.S. and are delivered by air without extra postage charges. Obligated by law to recover operating costs from sales, NTIS must price its products and services at a level which will cover the total costs of developing, producing, marketing, and delivering information.

As one of the leading processors of specialty information, NTIS ships each day more than 11,000 information products and delivers each year approximately four million documents and microforms. More than 800,000 are offered for sale from the NTIS information collection.

Most reports that result from Government-sponsored research are available from NTIS. It is the primary source for scientific and technological information developed by Federal agencies, their contractors and grantees. And it is a central source for Federally generated, machine-processible data files.

Through the agency's on-line computer service, NTISearch, over 400,000 Federally sponsored research projects completed since 1964 can be searched quickly to locate reports of interest. An additional 180,000 citations of on-going or recently terminated projects compiled by the Smithsonian Science Information Exchange are also computer retrievable through NTIS. Full-text copies of any of these research reports may be purchased in hard-copy form or on microfiche.

Abstracts of new research reports and other specialized technical information are published in a series of fully indexed weekly newsletters, *Weekly Government Abstracts*. For librarians, technical information specialists, and others who need complete current information in a single volume, categorized and indexed, the bi-weekly journal *Government Reports Announcements* is published.

All of these services, and others, are offered at cost to countries which can use newly developed technical information to speed their industrial progress. The three objectives of the USAID/NTIS experiment are to:

- facilitate the utilization of U.S. technical and scientific information in developing nations
- establish links between the scientific and technical information services of developing countries and NTIS
- strengthen through these links, the capabilities of those information services.

In this cooperative venture, NTIS provides developing nations with easy access to the ever-growing accumulation of information produced by Government-sponsored research in scientific and technological fields. And, equally important, NTIS helps those nations strengthen their own institutional and user capabilities to utilize advances in science and technology to further their industrial development.



A handwritten signature in dark ink, appearing to read "W. T. Knox".

William T. Knox, Director  
National Technical Information Service  
U.S. Department of Commerce  
Washington, D.C., U.S.A.



## Special Technology Groups Offer Unique Data to NTIS Clients

Special technology groups, sometimes referred to as Information Analysis Centers (IAC's), are concerned with the analysis and communication of the very latest in the state of an art. Some concentrate on evaluation of cultural, educational and socio-economic data. The hundred or more Federally sponsored in the U.S. are considered national resources of particular knowledge.

NTIS is the national marketing coordinator for various Special Technology Groups as well as IAC's and partially financed by the Department of Defense, the Atomic Energy Commission and the Department of Commerce, all of which have been required to recover their costs by making their products and services available.

Usually, Special Technology Groups define their operations within three principal areas.

**Technical Inquiry Services:** The custom searching of an information collection relevant to specific queries combined, by some, with analytical research and evaluation.

**Data Books & Research Reports:** Often these are state-of-the-art reports; that is, the best information on a subject. Also published in this category are annotated bibliographies, technical guides and directories and processes.

**Current Awareness Bulletins:** These reflect the latest technical achievements, in brief, as they are observed and recorded for subsequent detailed evaluation; usually available on a subscription basis.

NTIS is the national marketing coordinator for the following Information Analysis Centers and Special Technology Groups:

### Chemical Propulsion Information Agency

Covers performance calculations, chemical synthesis programs, combustion studies, propellant formulation efforts, physical and ballistic characterization, rocket design, ground testing of rockets, integration of rockets and flight vehicles, correlation of flight data with static test data.

Publishes extensively and maintains mailing list for exchange of chemical propulsion technical information.

### Mechanical Properties Data Center

Covers mechanical properties of structural materials, interacting variables, with major emphasis on metal alloys; maintains data on more than 4,000 specific alloys.

Answers questions, provides special bibliographies, technical evaluations, prepares Aerospace Structural Metals Handbook, special publications and inventory reports on the MPDC system.

### Metals and Ceramics Information Center

Covers the characteristics and utilization of advanced metals, ceramics, selected composites.

Answers technical inquiries, requests for literature searches, publishes weekly reviews, state-of-the-art reports, handbooks.

### Nuclear Safety Information Center

Covers nuclear safety—general criteria, analysis, operating systems, accident analysis, environmental surveys, monitoring and radiation exposure of man, siting and containment of facilities, transporting and handling of radioactive materials, reactor transients, kinetics and stability, nuclear instrumentation, etc.

Answers technical inquiries, publishes state-of-the-art reports, bibliographies, and provides current awareness services.

### Plastics Technical Evaluation Center

Covers structural composites, electrical and electronic applications, packaging, mechanical goods applications,

microbiological deterioration, test methods, specifications, compatibility and reactivity.

Answers inquiries, publishes state-of-the-art bibliographies, indexes, directories.

### Reliability Analysis Center

Covers microelectronic circuit devices, monolithic integrated circuits, metal oxide semiconductor integrated circuits, hybrid circuits, integrated arrays, also device fabrication, equipment assembly, operation.

Answers direct user inquiries, publishes monographs.

### Technology Application Center

Covers heat pipe technology, secondary waste glass, noise pollution.

Answers inquiries, publishes handbooks, books, current awareness bulletins and state-of-the-art reviews.

### Thermophysical & Electronic Properties Information Analysis Center

Covers 16 thermophysical properties of materials to representative groups: high temperature materials, thermal conductivity, thermal diffusivity, thermal expansion, reflectance, viscosity, specific heats and pressures.

Answers technical inquiries, makes reference literature searches, provides reference, consulting advisory services, reproduces research documents on microfiche. Compiles bibliographies, handbooks and special study reports. Publishes current awareness reports and state-of-the-art reviews.

### Toxicology Information Response Center

Covers general scope of toxicology. Concentrates on pesticides, bioenvironmental toxicants, toxic chemicals, food additives and drugs. Provides literature searches, critical reviews, state-of-the-art reviews, current awareness service and specialized bibliographies.

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**Dr. Hashoni, Director, Pakistan Science Foundation, and Science Advisor to the President of Pakistan, on a visit to William T. Knox, NTIS Director.**



## **Agricultural Economics**

### **Framework for Research on the Economics of Farm Mechanization in Developing Countries**

Michigan State University, Department of Agricultural Economics. Gordon Gemmill, and Carl K. Eicher. April 1973. 38 pages.

**PB-228 247/GIX**

**PC \$4.25**

an important phase of decision making in the developing countries is determining the rate and type of farm mechanization, particularly as related to optimum economic and social considerations. Such decisions may be quite difficult from a series standpoint and in light of the growing unemployment and underemployment problems in these nations. There is some confusion between the views of economists and agricultural engineers which the report avoids by concentrating on the strengths or shortcomings of economic research dealing with farm mechanization. A tentative framework is outlined for analyzing the social and economic implications of farm mechanization in developing countries. Major types of short, medium, and long term policy decisions are observed. A critical review is made of selected economic studies in the field in terms of research and policies. Suggestions are made for rectifying the research on farm mechanization to provide better policy guidance. The value of linear programming is noted, along with a need for proper budgeting.

### **Differential Rates of Adoption of the New Seed Varieties in India: The Problem of the Small Farm**

Michigan State University, Department of Agricultural Economics. Michael Schluter. August 1971. 70 pages.

**PB-228 826/GIX**

**PC \$4.25**

A small farm has received considerable attention in recent discussion of agricultural policy in India for two reasons. First, it is thought that rates of adoption of the new varieties differ between farm size groups, resulting in widening income disparities in rural areas. Secondly, small farms occupy a large number of people and contribute significantly to total agricultural production. This document examines whether there are really differences in rates of adoption of the new varieties between farm size groups and, if so, the reasons for the differences. Consideration is first given to prior reasons for expecting some relationship between farm size and adoption of the new varieties. An examination is made of the relationship between regions, crops, years, and seasons are considered. The results of the relationship observed between adoption and farm size are analyzed. Three of the main factors that are thought to influence adoption behavior are considered—the land—holdings, structure, irrigation availability, and credit availability.

### **Case Study in Agricultural Marketing: The Modern Rice Mill in India**

Michigan State University, Department of Agricultural Economics. John A. Lele. 1971. 24 pages.

**PB-228 834/GIX**

**PC \$3.25**

This case study is an analysis of the establishment and functioning of the first and the largest modern rice mill in India. It is written with a purpose of illustrating the complexity of factors that enter into the establishment and functioning of an enterprise in a low-income economy. These factors often distort the factor and the product prices and makes it difficult to measure the efficiency of an enterprise with the usual yardsticks of cost-benefit analysis. The development of a modern processing industry is regarded as subsidiary to the overall economic growth process and, as such, is affected by policies that often do not cater to the broader economic and political goals.

### **Sector Analysis and the General System Simulation Approach to Agricultural Development Planning**

Michigan State University, Department of Agricultural Economics. Michael H. Abkin, and George E. Rossmiller. 1972. 38 pages.

**PB-228 915/GIX**

**PC \$3.75**

Planning is now recognized as a necessary and legitimate activity of governments throughout the world. A broad objective of governmental planning is to solve immediate problems, to avert contemplated future problems, and to confront issues which may become problems if left unattended. An approach to planning and a planning tool are suggested in this paper. Although the context is that of agricultural development planning, the material presented is completely generalizable to other sectors of the economy and other aspects of the social system. Consideration is first given to the decision-making process itself, the inherent uncertainty of the information it requires and its universal use of models. Descriptions are then given of sector analysis and general system simulation as an approach to agricultural development planning. Finally, an examination is made of some of the advantages, costs, requirements, and limitations of the approach.

### **Agricultural Taxation in a Developing Economy: A Case Study of India**

Ohio State University, Department of Agricultural Economics and Rural Sociology. S. S. Johl. 1971. 35 pages.

**PB-228 942/GIX**

**PC \$3.75**

In the developing countries where average earnings per capita are low, there exist acute disparities in the incomes, and these disparities are more pronounced in the agricultural sector because of the acutely skewed distribution of the cultivated land. Yet, in spite of these disparities, with a good tax-paying ability of the upper-income groups, the agricultural sector passes as more or less a homogeneous sector in the taxing policies; and the agricultural elite class normally manages to take shelter behind the myth of a low or no taxpaying ability of the agricultural sector as a whole. This paper presents a case study of one of these countries (India) with a particular reference to one of the most progressive areas within it (Punjab) with a view to examining the possibilities of mobilizing additional resources from its agricultural sector without leaving any serious disincentives for its growth and development. Specifically the focus of the analysis is on: An assessment of the contributions of the agricultural sector to the total state revenue vis-a-vis the state revenue expenditure on development of agriculture; an assessment of the ability of the agricultural sector to generate taxable surpluses consistent with its growth; and development of a schematic approach on the agricultural tax structure leaving no serious disincentives to the growth and development of this sector. This analysis, it is believed, can be useful in providing some helpful guidelines to the agricultural taxation policy investigations in the other developing countries.

### **Process of Growth in a Dualistic Economy: The Interaction of Population Growth and Technological Improvements in Agriculture**

Ohio State University, Department of Agricultural Economics and Rural Sociology. S. S. Johl. 1971. 16 pages.

**PB-228 947/GIX**

**PC \$3.25**

A dualistic economy may be described as a two-sector closed system, such as an agricultural-industrial entity in which labor and capital flow freely between the two sectors. The report examines the intersectoral transfer of capital and labor in a labor surplus economy, under the conditions of population growth and improvements in agricultural technology. A further assumption is that income distribution in the agricultural sector is to be ignored; any change in the distribution of incomes in

agriculture, whether as wages or profits, will probably change the rate of investment and will shift the agricultural production function. The first part of the report deals with the two-sector growth of wages and employment, average agricultural wage rate per worker, and the productivity per worker which may change with the labor force level. The second part extends the argument to a situation of increasing population, or labor force, and interactions of technology improvement with labor redundancy, wage rates, and intersection transferring of labor and capital.

### **The Consumption Behaviour of Peasant Households: A Case Study of Punjab, India**

Ohio State University, Department of Agricultural Economics and Rural Sociology. I. J. Singh. November 1971. 57 pages.

**PB-228 956/GIX**

**PC \$4.25**

The report makes an estimation of the consumption functions for five subsistence crops in a peasant household. Subsistence is defined as the percentage of a crop retained by the household for its own consumption rather than marketed for profit. The most important crops discussed are wheat, maize, pulses or other grains, sugar, and rice. Two sets of factors are examined, real and market. Real factors include production of a subsistence crop or its near consumption substitute, and the size of the household; market factors include the harvest prices of the crop or its substitute, and household cash income. Time series and cross-section analysis provide a basis for household observations. An attempt is made to predict the peasant household consumption of several farm produced outputs and to view these predicted consumption levels as constraints on the production possibilities of the peasant farmer.

### **Sources of Change in Mexican Agricultural Production, 1940-65**

Department of Agriculture, Economic Research Service. Reed Hertford. August 1971. 116 pages.

**PB-229 394/GIX**

**PC \$5.25**

Two features have distinguished the process of agricultural development in Mexico. First, production has increased during a long period of time at rates easily exceeding those of other Latin American nations, except Venezuela. Second, Mexican public policy has emphasized agriculture to a significant extent. Since the mid-1930's the government has made exceptional commitments to increasing production levels and to improving the distribution of agricultural resources. Major public policies have involved large-scale irrigation projects and reform of land ownership. This document considers both these features. Its primary aim is to explain the rapid expansion in farm output that occurred during the period 1940-65. In addition, an effort is made to relate irrigation and land reform developments to the use of particular farm inputs and in returns to these inputs. Some of the topics included are: Highlights of Mexican agricultural development, with attention given to unusual features and international comparisons; general record of growth in total agricultural production, food consumption and foreign trade for 1940-65; estimated changes in total input and productivity for the period, and changes that took place in each category of farm inputs; relationship of input use to major public policy developments.

## **Agricultural Technology**

### **The Application of Nuclear Energy to Agriculture**

Inter-American Institute of Agricultural Sciences, Tropical

Training and Research Center (Costa Rica). Carl C. Moore. April 1973. 82 pages.

**COO-3217-18/GIX**

**PC \$6.25/MF \$2.25**

This report describes and discusses work carried out over a period of one year on various projects involving the application of nuclear energy to tropical agriculture. The topics covered include the following: Induced mutations in cassava, the common bean (*Phaseolus vulgaris*), and coffee; control of agricultural pests by male sterilization (sterilization of the Mediterranean fruit fly and its application to fly eradication; biology and sterilization of the coffee leaf miner, biology and sterilization of the meliaca shootborer); radiobiology in insect pathology (pathological control of insect pests, radiobiology and mutagenesis of insect pathogens). For the previous report on this continuing research effort see COO-3217-5 in AMTI, July 1973, page 115.

### **Design, Development, and Extension of Small-Scale Agricultural Equipment**

International Rice Research Institute (Philippines). Bart Durston. 1972. 25 pages.

**PB-228 082/GIX**

**PC \$3.25**

In discussing farm mechanization and the issues surrounding it, there is some tendency to call for levels of technology that are not readily available. In the case of Southeast Asia, so-called appropriate methods for machines and management do not yet exist. The International Rice Research Institute has been developing and extending agricultural equipment to meet the rice production needs of small farmers. The objective is to identify the operations in rice culture and processing wherein improved techniques can significantly advance the output and income of these farmers. The report discusses the variation of mechanization patterns for both the Philippines and tropical Asia. The patterns involve machine profitability, institutional features related to farm size, land control, and machine management, and long-term socioeconomic relationships between labor, profit sharing, and costs, as well as the variety of techniques available to individual farmers. The Institute seeks to span a gap in contemporary technologies, filling a role that the private sector seems unable to assume.

### **Nutrition of Rice**

National Fertilizer Development Center. September 1971. 94 pages.

**PB-228 302/GIX**

**PC \$4.75**

This document is comprised of more than 600 abstracts representing many of the most important articles on the subject of the nutrition and fertilization of rice published during the period 1964 thru 1970. The abstracts are arranged according to the country in which the work was done or, when this is unknown, the country in which the article was published. All abstracts are in English. Subject and author indexes are included.

### **A Partial Bibliography of the Vampire Bats (*Desmodus*, *Diphylla*, *Diaemus*)**

Bureau of Sport Fisheries and Wildlife, Denver Wildlife Research Center. Samuel B. Linehart. 1971. 59 pages.

**PB-228 319/GIX**

**PC \$4.25**



This bibliography contains 626 selected references to the world-wide literature on vampire bats. Publications dealing with ecology, behavior, physiology, and disease relationships of these rabies vectors are cited, whereas those dealing primarily with taxonomy, distribution records, records of attacks, and folklore are excluded. Each entry is indexed with respect to subject content of the publications.

### **Effect of Agricultural Use on Water Quality for Downstream Use for Irrigation**

Utah State University, Department of Agricultural and Irrigation Engineering. J. E. Christiansen. July 1973. 35 pages.

**PB-228 844/GIX**

**PC \$3.75**

Although many studies have shown that there is generally a deterioration in water quality along streams where there are diversions for irrigation and the return flows re-enter the stream, this does not mean that detrimental effects of irrigation outweigh the beneficial effects. This document takes a closer look at water quality criteria for irrigation, with primary consideration being given to the composition including all factors that degrade or enhance water with respect to its use for irrigation. An historical review of various proposals for classifying irrigation waters is presented with suggestions by the writer. Limitations of some of the more commonly used criteria are mentioned. Salt balance and the need for a favorable salt balance in an irrigated area are explained. Leaching requirement is included in the discussion because of its relationship to the management of irrigation water. A study of the composition of irrigation water along several stream systems in relation to various criteria for classifying water is presented.

### **Irrigation and Drainage by Mole Systems**

Utah State University, Agricultural and Irrigation Engineering Department. Komain Unhanand. January 1972. 59 pages.

**PB-228 845/GIX**

**PC \$4.25**

Studies on the possibilities using "mole" systems for irrigation and drainage are summarized in this report. The studies were aimed primarily at finding an efficient and economical means of draining excess water from the soil to accelerate the drying of the land surface to allow seed bed preparation and planting to the best advantage. This is important in the wet-dry climatic zones of Latin America and other regions. Mole drainage is inexpensive and requires very little initial cost to install, which makes it very attractive for developing countries. But it has disadvantages: some important ones being its short life, its requirements of machine power for installation, and its suitability only in clay soil. A conventional or single mole plow consists of a chisel-headed steel cylinder attached to a steel blade. The single mole channel, constructed by the mole plow, has a vertical slit formed above the channel. The excess water in the soil and runoff enter the slit, deposit sediment in the channel and thus not only reduce its flow capacity but also shorten its useful life. The double mole plow was designed with the concept that the mole channels constructed by it will have the slit located midway between the channels such that the sediment deposition in the channels is minimized. Descriptions are given of a laboratory model study, the design and fabrication of mole plows, field tests of the fabricated implement, and the study of the possibility of using the combined mole-pipe system for irrigation and drainage.

### **Research Progress Report on Inheritance and Improvement of Protein Quality and Content in *Sorghum Bicolor* (L.) Moench**

Purdue University, Agricultural Experiment Station. J. D. Axteell, D. L. Oswalt, et al. April 1973. 138 pages.

**PB-229 034/GIX**

**PC \$5.75**

The document is comprised of a series of papers written as part of an on-going research program on the genetic improvement of grain sorghum. The topics covered include: Components of nutritional quality in grain sorghum; genotype-environment interactions for yield, protein, lysine, oil, and seed weight in *Sorghum bicolor*; amino acid compositions of whole kernel and endosperm protein fractions of sorghum; evaluation of rapid screening procedures for identifying high lysine and high protein lines of sorghum; amino acid composition of sorghum grain and relationships between amino acids and protein; influence of supplemental nitrogen on the relationship between tannin content and in vitro dry matter and nitrogen disappearance in *Sorghum bicolor*; comparative studies of the use of bird resistant and nonresistant sorghum grain by chicks; effect of supplemental protein on the nutritive value of high and low tannin sorghum for the growing rat; a comparison of three-row and one-row plots for the evaluation and selection of lines for protein content; preliminary results of the first international protein yield and quality trial; rate of seed germination as a means for evaluating sorghum lines for their catechin-equivalent content and as an estimate of their nutritive value.

### **Development of a Procedure for Determining Spatial and Time Variations of Precipitation in Venezuela**

Utah State University, Department of Agricultural and Irrigation Engineering. Luis E. Ramirez. May 1971. 100 pages.

**PB-229 044/GIX**

**PC \$4.75**

The design of irrigation systems requires a knowledge of irrigation needs, and these needs are basically a function of two important factors: (1) Evaporation and/or evapotranspiration, and (2) precipitation. This report concerns the precipitation factor and, in particular, the distribution of precipitation in space and time in Venezuela. A review was made of the literature on precipitation analysis to determine what procedures are being used to analyze spatial and time variations of the precipitation in areas of the world with climatic features similar to Venezuela. An effort is made to select procedures that can be used to analyze available precipitation data in Venezuela, and to determine what procedures are useful for purposes of computing irrigation requirements. A determination is made of the reliability, in terms of accuracy, of mean values of precipitation for actual Venezuelan precipitation of different lengths and for computed probabilities computed from the records.

### **Analysis of Colombian Precipitation to Estimate Irrigation Requirements**

Utah State University, Utah Water Research Laboratory. James E. Hardee. May 1971. 63 pages.

**PB-229 060/GIX**

**PC \$4.25**

This document provides estimates of dependable and effective precipitation for various agricultural areas of Colombia, and relates the dependable precipitation to estimated potential evaporation to determine potential irrigation water requirements. Dependable precipitation is an index of the amount of precipitation that is available for crop use, based on a probability distribution. Potential evapotranspiration is an index of the actual evapotranspiration for a crop. Thirteen probability levels of precipitation were calculated for 97 meteorological stations throughout Colombia. Potential evapotranspiration was calculated from climatic data from 43 of these stations. The difference between the potential evapotranspiration and five probability levels of precipitation were calculated as an index of irrigation requirements.



### **Irrigation With Siphon Tubes**

Utah State University; and Ministerio de Obras Publicas, Oficina Edafologica de Occidente (Venezuela). Raymond W. Miller, Tito Guilarte C., and Eduardo Chavez. 1971. 28 pages.

**PB-229 280/GIX**

**PC \$3.75**

The employment of siphon tubes in irrigation systems eliminates secondary control ditches in general farm operation and can reduce the need for continual water regulation, labor, and uneven water application. Flow from a stable source is practically constant for whatever time is desired. Siphons are useful in various ways. Water can be diverted from main canals to irrigation ditches using large siphons. Smaller siphons (2 to 6cm diameter) can be used to apply water to small ditches, individual furrows, or areas between borders. Although most siphons used are of plastic, there are available siphons made of aluminum and of rubber. This document discusses a number of aspects of siphon use. Consideration is given to the calibration of siphons; determination of the rate of water to apply, with reference to soil intake rate, water needed by the crop, and application efficiency selection of a siphon size; use of siphons in research studies, including parshall flumes, measuring the "head," and precision water addition; avoiding errors in siphon use; and a suggested field layout.

### **Sprinkler System Distribution Evaluation Using the Superimposed Method**

Utah State University. Richard E. Griffin. August 1971. 57 pages.

**PB-229 370/GIX**

**PC \$4.25**

"Coefficient of Uniformity" ( $C_u$ ) is the term used to evaluate how evenly water is distributed from sprinkler irrigation systems. Small cans are placed in a specific pattern in relation to the sprinklers, and the amount of water collected in each can is used to calculate the  $C_u$ . This document explains the proper method of water collection and a method of calculating  $C_u$  from a single sprinkler. Actual use of the method in the Zapotitan Valley of El Salvador is described by way of proving an actual example.

### **Subsurface Asphalt Moisture Barriers in Sandy Soils**

University of Delaware, Agricultural Experiment Station. E. N. Scarborough, and W. C. Liebhardt. June 1973. 16 pages.

**PB-229 518/GIX**

**PC \$3.25**

The low productivity of deep sandy soils in humid areas can be attributed to their low water holding capacity and high losses of soluble nutrients by percolation. The production level of these soils can be appreciably raised by supplemental irrigation and frequent applications of fertilizer, when water is available. Another alternative is the construction of an artificial barrier below the root zone. This report describes studies of the effectiveness of a subsurface asphalt moisture barrier as an aid in soil moisture retention and reduction of nitrate leaching in sandy soils. Consideration is given to barrier construction, field studies on the yield of vegetable crops grown over asphalt barriers, and laboratory studies of nutrient retention over simulator barriers. The results indicate that the asphalt moisture barrier is an effective production tool for growing vegetable crops in sandy soil where irrigation is not feasible, especially under conditions of short periods of drought and occasional heavy rainfalls. (A closely related report is *Water Use Efficiency of Vegetable Crops Grown Over Asphalt Moisture Barrier*, PB-214 120. The price is \$3.00 for paper copy, \$1.45 for microfiche. See AMTID, July 1973, page 116.)

## **Building Technology**

### **The Design of Reinforced Concrete Floor Slabs Which Terminate at Edge Beams**

West Virginia University, Department of Civil Engineering. J. W. Saunders Jr., W. J. Wilhelm, and E. L. Kemp. 1972. 91 pages.

**PB-222 426/GIX**

**PC \$4.75/MF \$2.25**

Although reinforced concrete construction techniques have advanced rapidly from the extensive use of monolithic construction to the use of precast and prestressed components, the practice of pouring the beams, slabs, and columns in a single pour is quite common. The resulting structures have been designed by treating the beams, slabs, and columns on an individual basis, but if monolithic construction is to compete with other technology, the design must consider the interacting behavior of the components and behavior of the entire system rather than the behavior of the individual members. The document presents a design approach for monolithic reinforced concrete slab-beam systems where the slab terminates at edge beams on one or more sides. Consideration is given to deflections and stresses at working loads, and to the ultimate capacity of the system. A report is made on three large scale beam-slab-column systems which were tested to collapse. The results are compared with ACI allowable stresses. The design approach is then presented and illustrated by an example.

### **Active Control of Civil Engineering Structures**

Purdue University, School of Civil Engineering. James T. Yao and Jhy-Pyng Tang. July 1973. 30 pages.

**PB-222 594/GIX**

**PC \$3.75/MF \$2.25**

With the development of new materials with higher strengths, considerable engineering technology has been developed in the design and construction of more flexible structures. Increased flexibility of bridge structures, for example, appears to reduce fatigue susceptibility in stringers. Also as urbanization increases, a need is expressed for taller buildings, involving flexibility properties. At the same time an upper limit has been discovered in regard to building height; tenants on the top floors of certain buildings have experienced discomfort and other psychological effects, and some mechanical difficulties with wind loads have been noted. Thus the approach to structural engineering vs. safety and the comfort of people has produced the concept of structural control. The objective of the report is to explore the effect of active control on the response of flexible structures to dynamic loads. The problem of structural control is formulated, and solutions are obtained for certain cases of loads. As examples, the response control of one story and two story buildings subjected to wind loads and earthquake excitations are considered.

### **Component Building and the Organization of the Building Process. A Study of Joints and Joining. Components 1, 3, and 4**

Washington University, Building Industrialization Research and Development Group. Colin H. Davidson, Tibor Csizmadia, et al. 1971. 167 pages.

**PB-223 254/GIX**

**PC \$6.25/MF \$2.25**

As the building industry endeavors to meet the demands placed upon it by society, its members seek to improve their performance.

ance by various forms of technological innovation and organizational changes. One form that the technological innovations are often said to adopt is the component approach to building, using standard components for easy assembly. Such an approach presumes general agreement about the joints between the standard components. This report investigates the state of the art regarding component building and some of the technical implications on joints. It is found, however, that there are priority organizational and procedural problems that have to be understood before the technological innovation can take place. This report, therefore, places considerable emphasis on understanding the workings of the building industry, particularly insofar as they concern the questions of component building, standardization, responsibility for joints, etc. There are four components to the report: An Introduction; Information System—collection of abstracts, summaries of interviews and case studies; Factual Information—discussion of key terms, recommendations on joint design, glossary; and Debate—an analysis and synthesis of the results of the case studies. This volume contains the introduction, factual information, and debate components of the report.

**Component Building and the Organization of the Building Process: A Study of Joints and Jointing. Component Two—Information System, Volume 1**

Washington University, Building Industrialization Research and Development Group. Colin H. Davidson and Tibor Csizmadia. 1971. 229 pages.

**PB-223 255/GIX PC \$7.50/MF \$2.25**

The second volume in a three-volume series contains abstracts from an industrial survey of existing work and practices in the field of joints and jointing in component building. Some of the topics covered by the report are adaptors, adhesives, airconditioning, aluminum, assembly methods, automation, batch production, bolts, building codes, building sections and systems, caulks, ceilings, chemicals, claddings, compatibility, computers, concrete construction, constraints, construction management, costs, creep, contracts, curtain walls, dimension, durability, elastomers, explosions, failures, feedback, fibre glass, field tests, fire resistance, floors, frames, gaskets, glazing grids, gypsum board, hardness, innovation, inspection, insulation, joint configurations and junctions, jointing components and materials, joints, long term effects, machine tools, management, masonry, mastics, mechanical fasteners, metal forming, metrication, moduli, multistory buildings, panels, partitions, plywood, positioning, precast concrete, prediction, prefabrication, prevention, putties, quality control, reliability, responsibility, rivets, roll forming, roofs, scheduling, sealants, sheet metal, specifications, standardization, steel construction, stresses, systems analysis, tendering, tests, tolerances, ultraviolet light, variety, ventilation, walls, wastage, water, weather resistance, windows, and work planning.

**Component Building and the Organization of the Building Process: A Study of Joints and Jointing. Component Two—Information System, Volume 2**

Washington University, Building Industrialization Research and Development Group. Colin H. Davidson. 1971. 208 pages.

**PB-223 256/GIX PC \$7.25/MF \$2.25**

The third volume of a three-volume report on joints and jointing in component building contains abstracts, recommendations for component design, and standardization data. Some of the topics included are joint types, compounds, calk and sealant bases, failure types, materials properties, building codes, rain

and air leakage, external envelopes, precast concrete, windows, tolerances, cement, hardness and moduli, ultraviolet exposure, compatibility, variety, dimensions, movement testing, chimney action, masonry and walls, heat-air-water flow control, standardization, test methods, sealing materials, job planning, movement joints, roofs, framed structures, silicones, adaptors, plastics, failures, panels, responsibility, specifications, adhesion, durability, mathematical models, load analysis, policies, marketing standards, gaskets, ventilated systems, computer programming, automation, multifamily and multistory dwellings, prefabrication, interchangeability, cost analysis, and clearances.

**Planning and Cost Evaluation Program for Comparing Preliminary Design Schemes for Highrise Apartments**

Massachusetts Institute of Technology, Department of Civil Engineering. Thomas G. Harmon, Robert J. Hansen, and Jose M. Roesset. August 1973. 208 pages.

**PB-223 370/GIX PC \$7.25/MF \$2.25**

Cost estimation during all stages of design and planning of buildings has apparently not been used to fullest advantage. An initial effort is made to provide some better cost management approaches. First, some difficulties are noted: Accurate details are usually obtainable only at the end of a stage when actual quantities from working drawing are available. Preliminary costing data normally are derived from averages from completed buildings and thus are only crude. A complete set of design data is seldom available to one person. Also, a design team ordinarily does not consider construction methods that may vary according to the contractor. The report is limited to highrise apartment buildings during preliminary design. The framework is seen as composed of a cost-estimating capability over time, a forecast of income and expenses during original building operation, and a capability of generating alternate schemes. The computer is discussed as a means for organizing, storing, and applying the pertinent knowledge and experience, with predictive estimating as a useful tool for applying the accumulated data to an actual cost estimation.

**Live Load Effects in Office Buildings**

Massachusetts Institute of Technology, Department of Civil Engineering. Robin K. McGuire, and C. Allin Cornell. July 1973. 88 pages.

**PB-224 636/GIX PC \$4.75/MF \$2.25**

To date, no comprehensive study apparently has been made to compare the effect of the total gravity live loads with the design loads in current use of buildings. A probabilistic model is discussed that takes into account spatial and temporal variations in loading, spatial correlations, multiple story and room construction, and random load changes. The report examines beam moments, shears, and column axial loads, which represent a variety of influence surface shapes. The equivalent uniformly distributed load, a uniform load producing the same fragile effect as the actual spatially varying live load, is computed for several shear, moment, and axial force effects for various supported areas. Several methods are proposed to incorporate the results into a structural code format that will obtain design load effects with a consistent probability of being exceeded. Fractiles of office building live loads are compared with popular code recommendations. Several alternative forms of code presentation are given.



### Settlement Prediction: A Probabilistic Approach

Massachusetts Institute of Technology, Department of Civil Engineering. Jorge Diaz-Padilla, and Erik H. Vanmarcke. August 1973. 83 pages.

**PB-224 672/GIX**

**PC \$4.75/MF \$2.25**

It is now recognized that structural foundations and building superstructures do not operate as isolated systems. They interact, and this interaction must be accounted for in performance and safety engineering. The result is a necessity for using both limits and optimizations in design. The characteristics of sub-foundation soils become important, leading to better prediction of building settling. The report offers a probabilistic soil structure interaction model for describing movements of the foundation in terms of input loads and soil properties. The method so far is applicable only to linear elastic structures supported on shallow foundations, with bounds suggested for cases where settlement induced stiffness deterioration occurs. The uncertainty of joint displacements and the forces imposed upon the structure by random deformations of a foundation is noted in the discussion. The mathematical formulations include a sensitivity analyses for the large number of variables involved.

### Geometric Imperfections in Concrete Structures

National Swedish Institute for Building Research. Anthony E. Fiorato. 1973. 224 pages.

**PB-227 252/GIX**

**PC \$7.25/MF \$2.25**

Geometric irregularities, such as initial curvatures in columns, inclinations in columns or walls, and misalignments of various elements appear to be inevitable in the construction of cast in-situ or prefabricated structures. While absolute geometric accuracy is not critical, original imperfections must be limited. These deviations may arise during any stage of the process of manufacturing, setting out, and assembly, involving structural forms used, methods of curing, and storing characteristics. The report presents a definitive survey of present literature on the influences of tolerances and geometric faults on the behavior of statically indeterminate concrete structures. Topics of discussion are causes and effects of imperfections, field data on file, tolerance limits, control methods, and the relation of imperfections to analysis and design. The end desired is obtaining esthetically pleasing structures with a minimum of construction difficulties, legal entanglements, and costs.

### Reinforced Concrete Corners and Joints Subjected to Bending Moment: Design of Corners and Joints in Frame Structures

National Swedish Institute for Building Research. Ingvar H. E. Nilsson. 1973. 258 pages.

**PB-227 263/GIX**

**PC \$8.50/MF \$2.25**

The report presents experimental work on the reinforcement of corners and joints in concrete structures where bending moments occur. Five causes of failure in these corners and joints are discussed: diagonal tension cracks, splitting cracks, reinforcement yielding, anchorage destruction, and concrete crushing. Of these, special attention is devoted to diagonal tension crack failure. Simple expressions are derived for analysis of this type of failure, based on truss analogies. The experimental work described was centered on corners subjected to tension on the inside, or positive moments. A solution is presented for reinforcing such corners. Other types of joints with similar constructional problems are studied, such as corners in retaining walls. T joints and X joints are investigated. Some proposals are advanced for simple and functional reinforcement layouts for corners or common types of joints in reinforced concrete structures subjected to bending moment.

### Simplified Housing Construction Systems for Rural Poor Families

Southern Illinois University, Department of Design. J. Michael De Rienzo. January 1973. 248 pages.

**PB-227 616/GIX**

**PC \$7.50/MF \$2.25**

It can be of substantial benefit to certain groups in an underprivileged rural setting to have available information on simple construction techniques, the use of innovative materials, and use of common but often unrecognized materials for building. The majority of individuals wishing to improve their family living may be assumed not to have the knowledge or ability to construct unaided a standard dwelling. In addition, much of the information that is obtainable is antiquated, so that any financial or technical support that is given these families may not have the advantages of current technology or creative low-cost practices. The report presents some guides and recommendations for producing simplified living units, neither altogether optimal nor ideal, but useful in various mechanical, environmental systems, living and space conditions, and site characteristics. Self-help information is given on the selection of sites involving land slope, soil, and trees; windows and ventilation; interior spacing of halls, bedrooms, and the kitchen and utilities, such as plumbing, lighting, and heating. Data are presented on choice of materials and methods of assembly. Diagrams and cost tabulations are given.

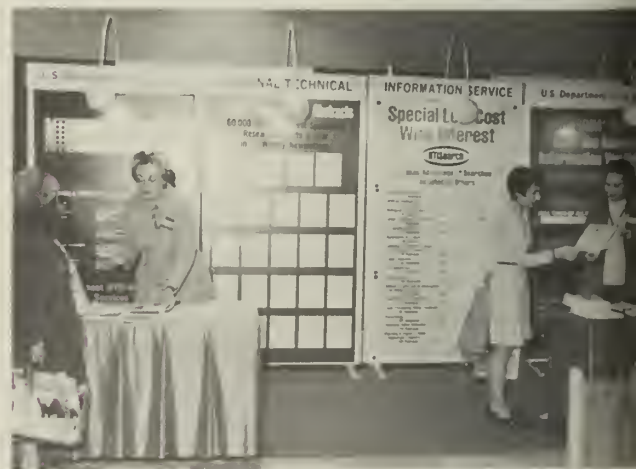
### Trigonometric Relationships for Geodesic Domes, With Special Reference to the Dodecahedron

Canadian Forestry Service, Western Forest Products Laboratory. J. C. Bohlen. January 1974. 27 pages.

**PB-230 772/GIX**

**PC \$3.75/MF \$2.25**

Over the years, there have been many attempts to design low cost housing units using wooden structural elements. There has recently been an increasing interest in using wood-framed geodesic domes for this purpose. This document introduces architects and structural engineers to basic spatial relationships for geodesic domes, and develops a method for determining a three-dimensional coordinate system for use in graphic presentations and stress analyses. A specific example (dodecahedron) is presented, which could provide the basis for the architectural design of a wood-framed geodesic dome used as a dwelling unit. Tables are presented which indicate member lengths, face angles, and the cartesian coordinates of member intersection points over a range of dome heights.



Librarians attending the International Federation of Library Associations' annual meeting held in November 1974 in Washington, D.C. received complete information about services and publications available from NTIS.



## **Chemistry & Chemical Processing**

### **Methods for Producing Alumina From Clay. An Evaluation of a Sulfurous Acid-Sulfuric Acid Process**

Bureau of Mines, College Park Metallurgy Research Center. J. Barrett, P. W. Johnson, and F. A. Paters. July 1973. 10 pages.

AD-722 597/GIX

PC \$3.75/MF \$2.25

This report is one of a series prepared to show the relative merits of known processes for the recovery of alumina from bauxite aluminum ores and to indicate areas of research that appear to warrant further experimental investigation. In particular, it provides a technical and economic evaluation of a sulfurous acid-sulfuric acid process for recovering alumina from clay. The process involves the successive leaching of clay with sulfurous and sulfuric acids. The resulting aluminum sulfate and aluminum sulfate solutions are reacted to form a basic aluminum sulfate precipitate that is, in turn, subjected to causticification to remove silica and other impurities. Alumina trihydrate is then precipitated and calcined to alpha-alumina. The process is technically feasible. The effects of the costs of clay, electrical power, and natural gas on the process estimated operating cost are shown; and comparison is made with the capital and operating costs of other alumina processes.

### **Study of the Technical and Economic Feasibility of a Hydrogenation Process for Utilization of Waste Rubber**

Hydrocarbon Research, Inc. R. H. Wolk and C. A. Battista. August 1973. 150 pages.

AD-722 694/GIX

PC \$5.75/MF \$2.25

This process is described in this report by which waste rubber stock, in the form of ground rubber tires, can be converted to a hydrogenation reactor operating at conventional petroleum industry conditions to fuel gas, naphtha, gas oil, and carbon black. The process, called the H-Rubber Process, is carried out in a continuous ebullating bed either in the presence or absence of commercially available hydrotreating catalysts. This report describes the process and demonstrates its technical feasibility; provides an evaluation of the value of the solid and liquid products; and presents a preliminary model of a commercial process sheet. It is shown that the overall economics are primarily dependent on the cost of collecting and grinding the waste rubber, and the value of the carbon black product.

### **Copper Recovery From Chalcopyrite by a Roast-Leach Procedure**

Bureau of Mines, Reno Metallurgy Research Center. P. R. Skett, D. J. Bauer, and R. E. Lindstrom. March 1973. 10 pages.

AD-728 103/GIX

PC \$3.25/MF \$2.25

This is an alternative to the smelter-based process for the recovery of copper and other nonferrous metals, roasting combined with hydrometallurgy is of increasing interest to industry as a possible means of controlling SO<sub>2</sub> emissions. A sulfation roasting technique is described which is an effective procedure for recovering copper in a soluble form from a chalcopyrite ore concentrate. The sulfation reaction is promoted at 400° to 500° C by the addition of Fe<sub>2</sub>O<sub>3</sub> to the roasting charge. The soluble copper is extracted by leaching with water and a dilute acid.

### **Rapid Wet Chemical Methods for the Analysis of Blast Furnace Slags**

Bureau of Mines. R. H. Jefferson, E. A. Hattman, and D. J. Slater. 1974. 19 pages.

AD-731 276/GIX

PC \$3.25/MF \$2.25

This report describes a series of rapid, wet chemical methods for the analysis of blast furnace slags. A "complete" analysis for total iron, manganese, silica, lime (calcium oxide), magnesia (magnesium oxide), sulfur and mixed oxides (R<sub>2</sub>O<sub>3</sub>) can be routinely performed in less than three hours. Most of the methods are variations of the classical methods; they have been altered where possible to reduce the time requirement without greatly reducing the precision and accuracy of the procedure. These methods are not presented as the most precise or the most rapid, but rather as a combination of speed, accuracy, and simplicity that produces results that fall well within a satisfactory range of precision and accuracy for most control work. Such methods are also useful for quick checks on more sophisticated methods.

## **Civil Engineering**

### **Thick Walled Multiple Opening Reinforced Concrete Conduits**

University of Illinois, Structural Research Laboratory. M. O. Ryan, M. H. Salem, W. L. Gamble, and B. Mohraz. December 1972. 199 pages.

AD-766 813/GIX

PC \$7.00/MF \$2.25

This report provides the results obtained thus far in a program that is intended to furnish information needed for the rational design of conduits or "box culverts" suitable for use under earth dams and other embankments with fill heights ranging up to about 250 feet. At this fill height the maximum pressure acting vertically on the structure may be as much as 45k/ft<sup>2</sup>. Currently used design guides were prepared assuming fill depths of no more than 60 to 70 ft., and maximum earth pressures of 8 to 10k/ft<sup>2</sup>. This report fills some of the gaps in the existing information by providing new experimental data on the behavior of concrete conduits; and it interprets this data in view of information gained from theoretical studies which are made taking into account as many variables as possible, including cracking of the concrete and the nonlinear stress-strain characteristics of the materials. This is expected to lead to the development of a design procedure directly applicable to the conduit problem.

### **Spillway Crest Design**

Army Engineer Waterways Experiment Station, Hydraulics Laboratory. T. E. Murphy. December 1973. 16 pages.

AD-774 802/GIX

PC \$3.25/MF \$2.25

There has been no simple universal procedure for the design of dam overflow spillway crests. The designer has had to follow one set of rules if the approach depth is deep and another if the approach depth is shallow. Also, there are different sets of rules depending on the inclination of the upstream face of the spillway. A design method is presented in this document which involves one procedure regardless of depth of approach or inclination of the upstream face of the spillway.

### **Fish Protection at Water Diversions and Intakes: A Bibliography of Published and Unpublished References**

Argonne National Laboratory. Rajendra K. Sharma. May 1973. 36 pages.

ANL/ESP-1/GIX

PC \$4.00/MF \$2.25

There exists considerable information on guiding fishes at water diversions and screening them at intakes. This bibliography contains more than 200 references to the literature on the subject. An effort is made to include references to all information pertaining specifically to fish protection at power plant intakes. A subject index is included.

### **Proceedings, Sixth Land Surveyors Conference**

University of Kentucky, Office of Research and Engineering Services. June 1973. 54 pages.

**PB-222 863/GIX**

**PC \$4.25/MF \$2.25**

These proceedings contain papers presented at a conference convened to present the latest available technical information to land surveyors. The topics covered include: Legal implications involved in retractions; modern methods applied to a complex urban subdivision layout; land descriptions; today's approach to land planning.

### **Hydraulic Model Studies of Chute Offsets, Air Slots, and Deflectors for High-Velocity Jets**

Bureau of Reclamation, Engineering and Research Center. G. L. Beichley. March 1973. 42 pages.

**PB-223 152/GIX**

**PC \$3.75/MF \$2.25**

High velocity water jets discharging through slide gates into concrete lined tunnels and chutes at dam outlets can cause serious erosion problems downstream. This report concerns methods of entraining air into the bottom and sides of such jets as a means of preventing cavitation erosion. The study results may be useful in designing aeration devices. Application is general, except for situations differing greatly from the test cases, in which event separate hydraulic model studies are needed. The model studies were conducted for two existing dams and three proposed structures. A single test facility was developed to model the constructions. Wall air vent slots combined with a floor deflector provided a methodology for use immediately downstream from the gate frames of the existing structures, whereas wall and floor air vent offsets away from the flow at the end of the frame were developed for the new structures. A basis was thereby obtained for finding guidelines to protect flow surfaces from cavitation erosion.

### **Creep of Concrete Under Stochastic Live Load**

Massachusetts Institute of Technology, Department of Civil Engineering. Robin K. McGuire, and C. Allin Cornell. October 1972. 51 pages.

**PB-224 652/GIX**

**PC \$4.25/MF \$2.25**

Creep in concrete has been studied extensively both in the U.S. and abroad. The methods for predicting this creep vary from simple rule of thumb guides to elaborate computer analyses on a time-incremental basis. Usually nonlaboratory predictions can only estimate the time dependent response. Recently an interest has grown in the statistical analysis of live loadings in public buildings. In any case, the loading on concrete is the single most important factor influencing creep. In light of some recent live load surveys and the probabilistic descriptions they provide, a model approach to creep deflection in the probabilistic manner examines the effects of a time varying load on deflection response. The report discusses the creep parameters of reinforced concrete, modeled as random variables, including the magnitude of and time between changes in live loading, and the cross sectional properties of the concrete beam. The mean and variance of the beam deflection are calculated, along with fractiles of the maximum life-time deflection. Results are presented as a mathematical function of the mean rate of change of the stochastic live load.

### **Structural Design Data for Concrete Drift Linings in Block Caving Stopes**

Bureau of Mines, Denver Mining Research Center. Jay D. Dixon. 1973. 81 pages.

**PB-227 548/GIX**

**PC \$4.75/MF \$2.25**

In block caving, sections of a large ore body are undercut and

allowed to cave in. The ore crushed in the process is then removed through utility passageways, or drifts. Stopes are described as steplike excavations underground for the removal of ore mined in successive layers. Structural design data have been developed for unreinforced concrete tunnel linings for drifts used in block caving stopes. The report discusses design data involving moment, thrust, and deformation coefficient from which bending, axial, boundary stresses, and structural deformations can be determined at any point on the lining. These data provide for the calculation of the stresses and deformations due to loads applied to the linings. Information is given for circular, horseshoe, and rectangular linings, each with two different thicknesses and subjected to eight different loading conditions for drifts excavated in hard and soft rock. Deformational interactions between the lining and the drift are also considered.

### **A Computer Program for Estimating Costs of Tunneling (COSTUN)**

Harza Engineering Co. Frank T. Wheby and Edward M. Canek. October 1973. 552 pages.

**PB-228 740/GIX**

**PC \$13.00/MF \$2.25**

The report describes COSTUN, a computer program for estimating the construction costs of tunnels and shafts, either as underground headings or as cut-and-cover projects. The program is aimed to provide cost estimates for planning and feasibility studies, permit selection of a minimum cost route from a number of alternatives, supply a means of identifying minimum cost methods for stated tunnel designs and sites, give a basis for comparing alternative geometric configurations with end-use requirements, or provide a check of reasonableness in engineers' estimates. In addition, a comparison may be made of the design costs, using costs of a standard design built into the computer program. COSTUN is intended primarily for tunnels and shafts for transportation, although it may be useful for hydraulic or utility applications. The objective is to duplicate the thought and reasoning processes required for detailed planning, quantity take-offs, and cost analyses. Some possibilities for error are noted. Complete operating instructions and an illustrative example are included.

### **Translations of Papers Presented at the Third Panel on the Peaceful Uses of Nuclear Explosions, Organized by the International Atomic Energy Agency, Held in Vienna, Austria, 27-30 November 1972**

Atomic Energy Commission, Office of Information Services. November 1972. 241 pages.

**UCRL-Trans-10701/GIX**

**PC \$7.60**

This document is comprised of English-language translations of papers presented in French, Spanish, and Russian at the Third IAEA Panel on Peaceful Uses of Nuclear Explosions. The topics covered include: Design of a waterway connecting the Orinoco and Rio Negro Rivers in the Federal Territory of Amazonas, Venezuela; forecasting the radioactivity level likely to result from a contained explosion; underground storage age cavities produced by nuclear explosions; experimental and theoretical studies of dimensions of craters produced by chemical explosives; geophysical importance of nuclear explosions; the art of using nuclear explosions to create underground storage age cavities in rock-salt masses; effect on buildings of the seismic waves from underground nuclear explosions; seismic safety during underground nuclear explosions; use of large scale explosions in dam construction; phenomenology of the contamination of the atmosphere and the ground by the radioactive products of underground nuclear explosion; rock activation and creation of radioactivity carriers by underground nuclear explosions; the national program for the use of peaceful nuclear explosives in the national economy of the Republic of Venezuela; the French peaceful nuclear explosion program



## Computers

### Minicomputers in Health Sciences Instruction

Massachusetts General Hospital, Laboratory of Computer Science. Christopher R. Brigham. August 1973. 40 pages.

**B-224 397/GIX PC \$3.75/MF \$2.25**

The minicomputer may be generally described as having small physical size, an instruction set of less than 80 operations, a word length of 18 bits or less, a standard core memory size of 4096 words (expandable), and an internal operating speed of 1-4 microseconds per full word addition. Minicomputers are currently being explored with the goal of making computer assisted instruction less expensive and more accessible. The report examines the history of these computers, their present status and expected future, their hardware and software, use as an instructional medium in the health sciences, their potential for health sciences education, and related applications. Minicomputers and larger machines are compared. Discussions are made of programmable calculators, single-user systems, intelligent terminals, and time sharing. A glossary of terms is provided. One example is presented: A computer controlled manikin as a simulator for anesthesiology instruction. Under the instructor's guidance, the manikin responds to a student's actions by changes in respiration rate, temperature, blood pressure, and heart rate, as well as by eye pupil dilation, and other physiological events.

### Making Computers Keep Secrets

Massachusetts Institute of Technology. Leo J. Rotenberg. February 1974. 394 pages.

**B-229 352/GIX PC \$10.25/MF \$2.25**

The computer makes possible new services and new interconnections of organizations and individuals that might have profound impact on the quality of life in the future. In addition to its beneficial potential, the computer will also support systems that severely degrade the quality of life. For example, the computer could easily provide the basis of a centralized dossier system, enmeshing citizens in institutional evaluations based on records held by unforgivingly long-memory computers. This document concerns a computer utility that has been designed with hardware and software mechanisms for protecting the privacy of information, mechanisms for storing authorizations and interfacing to a bureaucracy or other organizational form, and mechanisms to support proprietary services in a computer utility in a context that protects the interests of lessors and lessees of services. Topics covered include: Description and analysis of the social environment impacted by information technology; review of early work in the area of computer protection mechanisms; the concept of "domain"; new protection mechanisms that will support proprietary services in a computer utility, and will reduce the cost of operating system development; nine protection problems—such as services which steal information or sabotage their lessees, and lessees who conspire to steal secrets from their lessors—and technological solutions to some of these problems; a mechanism which can protect information owners from would-be copiers of their information; hardware and software of a multi-processing computer system which implements privacy restrictions; a newly designed authorization mechanism.

## Earthquake Engineering

### Three Dimensional Analysis of Building Systems

University of California, Earthquake Engineering Research

Center. E. L. Wilson and H. H. Dovey. December 1972. 105 pages.

**PB-222 438/GIX PC \$5.25/MF \$2.25**

Several two and three dimensional general computer programs are available for the linear mechanical analysis of complex structures, but for a building system they present some difficulties. Input data are unnecessarily complex when most buildings are of simple geometry with horizontal and vertical members; many frames and shear walls are typical; the loading is restricted, applied for certain conditions at a limited number of locations and floor systems are rigid, leading to possible numerical errors. The report develops a procedure and a computer program for the linear structural analysis of frame and shear wall buildings subjected to both static and earthquake loadings. The building is idealized by a system of independent elements for frame and walls, interconnected by floor diaphragms rigid in their own plane. Within each column deformations are considered for bending, axial forces, and shearing. Nonprismatic configurations are included. Static loads may be combined with a lateral earthquake input which is specified as a time dependent ground acceleration or an acceleration spectrum response. A significant reduction in computation effort can be obtained.

### Probabilistic Analysis of Elastoplastic Structures

Purdue University, School of Civil Engineering. Thomas Lee Paez and James T. P. Yao. August 1973. 81 pages.

**PB-223 328/GIX PC \$4.75/MF \$2.25**

In civil engineering considerations, the dynamic loads imposed by wind storms or strong seismic motions are significant in the safety analysis and design of structures. When extraordinarily large loads occur, the behavior of most structures is nonlinear, often resulting in plastic deformation. Since excessive deformation could cause a structure to fail it is important to study response beyond the linearly elastic range. The report is concerned with the first excursion beyond the threshold of this limit. A method is presented for computing the first-passage probability for a linear or nonlinear structure. In addition, the probability distributions of accumulated plastic deformation and permanent set in elastoplastic structures are found. Several numerical examples are given. Materials included deal with a literature review, general considerations, stationary excitation of elastic structures, formulations and solutions for elastoplastic structures, and the first passage of elastic structures. The use of narrow bandedness and the effects of random vibration are discussed.

### Analysis of the Slides in the San Fernando Dams During the Earthquake of February 9, 1971

University of California, Earthquake Engineering Research Center. H. Bolton Seed, K. L. Lee, et al. June 1973. 314 pages.

**PB-223 402/GIX PC \$9.25/MF \$2.25**

The effects of the severe 1971 earthquake in the San Fernando, California, area have been receiving concentrated study by geologists, seismists, and designers of buildings and dams. The report deals with land slides at the lower and upper San Fernando dams, especially the major slide in the upstream slope of the lower San Fernando embankment dam. The near-catastrophe resulting from the earthquake-induced slides in these dams raised a number of questions concerning the adequacy of earth dam design criteria to protect the public against failures resulting from earthquake shaking. The report is intended to answer the questions of whether the slide movements developed in the foundation or in the embankment soils, whether the mechanics of sliding was primarily due to liquefaction or to more conventional slide mechanisms, whether existing analytical procedures are adequate to predict slide movements of this type, and whether new criteria are required for evaluating the seismic stability of earth dams.



### **The Engineering Aspects of the Qir Earthquake of April 10, 1972 in Southern Iran**

National Academy of Engineering, Committee on Natural Disasters. Reza Razani, and Kenneth L. Lee. 1973. 162 pages.

**PB-223 599/GIX**

**PC \$6.25/MF \$2.25**

The report is an examination of earthquake risks and earthquake hazard minimization, underlining the urgency of enforcement of seismic building codes for urban construction. The event considered is a destructive earthquake of magnitude 6.9 occurring in the mountainous region of southern Iran near the town of Qir, in which an area of 4,000,000 square kilometers was shaken and the town of Qir along with neighboring villages became leveled. Effects on the land, soil, and building foundations were minor; destruction of adobe and masonry dwellings was disastrous. Only a few engineered structures were involved; the most important ones were a 10 span reinforced concrete bridge and an elevated steel water tank which both survived with insignificant damage. Failures of adobe and masonry buildings with steel beams and shallow brick arch roofs or heavy flat timbered roofs resulted from the poor quality of construction material and workmanship. Following an examination of the damage, recommendations are made for improving the seismic strength of structures as well as for conducting necessary research, education, organization, and legislation for the future in Iran.

### **Quad 4: A Computer Program for Evaluating the Seismic Response of Soil Structures by Variable Damping Finite Element Procedures**

University of California, Earthquake Engineering Research Center. I. M. Idriss, J. Lysmer, et al. July 1973. 80 pages.

**PB-229 424/GIX**

**PC \$4.75/\$2.25**

The finite element method of analysis has been shown to be a powerful tool for the solution of various problems in continuum mechanics. Among its many uses, it has been applied extensively for the evaluation of the seismic response of a variety of soil deposits and earth structures. Although the analytical formulations permit the use of different stiffness characteristics in each element, all applications to date for evaluating the response during earthquakes have utilized a constant damping ratio for the entire finite element representation. In fact, however, damping in soils is strain dependent, and the damping value to be used in each element should be based on the strain developed in that element. Furthermore, with irregular boundary conditions and variations in material properties, these strains may vary considerably. Thus, the use of a constant damping value, even though it may be the weighted average of the damping values for each element, can lead to inaccurate results for some conditions. Accordingly, an analytical procedure that permits the use of a different damping ratio for each individual element has been formulated. This procedure allows the incorporation of both stiffness and damping values, that are strain-dependent, for each element. The formulation of this variable damping finite element procedure, its use in response evaluation, and a listing of the computer program used in these evaluations are presented in this report.

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## Economics of Development

### Changes in Population and Employment as Processes in Regional Development

Oak Ridge National Laboratory, Urban Research Section; and Oak Ridge Population Research Institute, Clifford H. Patrick, and P. Neal Ritchey. April 1973. 29 pages.

**ORNL-UR-102/GIX** **PC \$3.50/MF \$2.25**

The interdependence of population redistribution, spatial dispersion of economic activity, and industrial diversification as economies evolve is apparent. However, the relationship of these processes as they occur simultaneously in a region's development from a rural agrarian economy to a metropolitan service-dominated economy has not been explicitly developed. Drawing on previous research, a paradigm is developed in this document that interrelates the three processes as they occur in economic development. Since the empirical basis for this paradigm primarily rests on national trends, its applicability to subnational regions is examined. It is shown that the paradigm appears to be useful as a model for indicating the broad patterns of change that can be expected to occur as a region develops.

### Productivity: A Selected, Annotated Bibliography—1965-71

Bureau of Labor Statistics, Office of Productivity and Technology. 1973. 113 pages.

**B-224 249/GIX** **MF \$2.25**

The bibliography covers productivity as the relation between output and input, especially directed toward economic policies, technological change, employment and skills, price and cost trends, and the availability of goods and services. It provides annotated references for nearly 800 publications dealing with concepts, methods, measurements, and economic variables. Some of the factors discussed are labor and education, management and organization, economic growth, capital considerations, and statistical data.

### Productivity and the Economy

Bureau of Labor Statistics, Office of Productivity and Technology. 1973. 69 pages.

**B-224 687/GIX** **MF \$2.25**

Productivity is a concept that expresses the relationship between a quantity of goods or services produced, as output, and the quantity of labor, capital, energy, and other resources needed to produce it, as input. Productivity may be measured either as related to a single input or with regard to a composite of inputs combined to reflect their relative importance. It is involved in one way or another with most issues of economic policy; during slowdowns, for example, interest centers on changing technologies, while during rising price periods, attention is directed to wage considerations. The report is intended as a chartbook for indicating how productivity operates. First it notes how productivity has developed over time. Next it presents changes in the factors which are influenced by productivity. Then it traces trends in the various factors observed. Some comparisons are made between nations. Some implications are for productivity growth regarding price and cost stability, output per person, and employment.

### Finance and Cost-Benefit Analysis: The Case of Foreign Loans

Harvard University, Development Research Group. Millard Long. April 1972. 34 pages.

**B-228 825/GIX** **PC \$3.75/MF \$2.25**

To get the most out of foreign capital flows and to avoid debt servicing problems, developing nations must be selective in their choice of foreign loans. Little work has been done on this problem; existing approaches, such as the debt service ratio and measures of grant equivalents, are likely to lead to less than optimal choices. This paper shows how cost-benefit analysis can be applied to the problem. First a critique is given of prior work. Crucial to the choice of loans is a measure of the present and future scarcity of foreign exchange. Various measures of this have been proposed. It is then indicated that the choice of measure depends upon the policies to be followed. Finally, it is shown how cost-benefit analysis can be applied to loan appraisal by examining an example chosen not for realism but to illustrate the special problems involved. These vary from source and project tying which reduce the real value of benefits to international inflation and exchange rate changes which reduce the cost of repayment.

### Multisectoral Models in Development Planning: A Survey

Harvard University, Development Research Group. Lance Taylor. March 1973. 134 pages.

**PB-228 839/GIX** **PC \$5.75/MF \$2.25**

Multisector models have been used for almost 20 years for planning in developing countries. Their place as a planning tool seems assured; indeed, they generate enough interest to call forth a slow but steady stream of methodological improvements. One purpose of this survey is to show to what extent all these models are interrelated, both in theory and from the point of view of the user. Another purpose is to present guidelines on the costs and benefits of different types of models, so that planning offices and academic researchers can make informed judgments as to the extent to which they wish to involve themselves with the various techniques. Five general categories of models are considered: Nonoptimizing projection models; dynamic input-output models; static linear programming models; dynamic linear programming models; and nonlinear models. Some possible future areas of research are pointed out.

### A Uniform Analysis of Development Patterns

Harvard University, Center for International Affairs, Hollis B. Chenery, Hazel Elkinton, and Christopher Sims. July 1970. 65 pages.

**PB-229 540/GIX** **PC \$4.25/MF \$2.25**

There is currently great interest in economics and other social sciences in identifying and describing the uniform features of the processes of modernization and development. Characteristics of the social and economic system that vary systematically with the level of per capita income may be described as development patterns. This document extends the methods of intercountry regression analysis to a wide variety of structural features in order to present a systematic picture of development patterns. The main purpose is to provide a consistent description of development patterns that can be used as a basis for inductive theory. The value of econometric analysis of intercountry relations is demonstrated and their general stability over time is confirmed. Although time trends are observable in a few development patterns, they are not large enough to distort an analysis based on cross-country relations very seriously. The analysis of structural features is used as part of an explanation of sources of growth and shows that growth processes differ considerably between underdeveloped and developed economies.



## Energy

### Fuel Cells: A Survey

Computer Sciences Corporation. Bernard J. Crowe. 1973. 112 pages.

**N73-26045/GIX**

**PC \$5.25/MF \$2.25**

Fuel cells, known in principle for more than 100 years, are today being used or considered for a variety of tasks. They have actual or potential advantages such as freedom from toxic exhaust, relatively quiet operation, basic simplicity, and high efficiency. This document provides a factual review of fuel cells and describes their current status. Problems as well as potentials are considered, and the changes with the various fuels are discussed. Sources of further information are listed. (Paper copy available only from: U.S. Government Printing Office, Washington, D.C. 20402, U.S.A.; price—85 cents. Microfiche copy is available from NTIS.)

### Bureau of Mines Energy Program—1972

Bureau of Mines Bartlesville Energy Research Center. Bill Linville, and John D. Spencer. 1972. 117 pages.

**PB-224 399/GIX**

**PC \$5.25/MF \$2.25**

The report discusses findings of some 20 research investigations on the conservation and use of petroleum, natural gas, oil shale, and coal. The chapter sections cover such features as stimulation of petroleum production by formation fracture, acoustic monitoring, and oil recovery by water or gas flooding; oil recovery from tar sands; fuel economy; petroleum exploration by gamma rays and geochemistry; reservoir flow and multiphase fluid mobility; crude oil quality; oil spills; asphalt studies; waste oil recycling; energy relationships of light hydrocarbons; high energy fuels; coal gasification; environmental effects of fuel combustion; oil shale processing and shale oil quality; clean fluid fuels from coal; advanced coal products research including chemical and toxic properties; and experimental equipment and instrumentation. Power-plant fly ash removal and use, coal and char combustion, coke manufacture, coal mine health and safety, coal storage and handling, and electric power production from coal are also discussed.

### Hydrogen and Other Synthetic Fuels

Atomic Energy Commission, Synthetic Fuels Panel. September 1972. 135 pages.

**PB-224 482/GIX**

**PC \$5.75/MF \$2.25**

An assured long-term supply of energy is essential for the growth and maintenance of industrial and industrializing nations. Today's energy needs are served primarily by direct use of fossil fuels and secondarily by electricity. Synthetic fuels from nonfossil sources appear to be the most likely alternative for supplying the long-term needs for gaseous and liquid fuels. These fuels, as considered in this document, consist of hydrogen obtained from water and synthetic fuels containing hydrogen, namely ammonia, hydrazine, methanol, and related substances. In the near future these fuels can, and most likely will, be made more economically from fossil sources such as coal and oil shale, or possibly from urban and agricultural waste products. The document analyzes and discusses all aspects of an energy system based on nonfossil synthetic fuels and includes discussions on the production of the fuels; their storage, transmission, and end uses; and an overall systems analysis illustrating the role that these fuels might assume in the future. A section on the use of coal to produce hydrogen and methanol is also included to help define the interim time period before dependency on nonfossil fuel occurs.

### A Rational Method for Evaluating Solar Power Generation Concepts

Colorado State University, Department of Civil Engineering. George O. G. Lof, and Susumu Karaki. May 1973. 11 pages.

**PB-227 822/GIX**

**PC \$3.25/MF \$2.25**

Increasing demands for energy, coupled with an increasing stringency in the requirements for protecting the environment, have led to the consideration of additional energy sources. One of these is solar energy, which has the advantages of abundance, inexhaustibility, universal distribution, and cleanliness. Its low intensity and high variability, combining to make its recovery costly for most applications as yet, are disadvantages. The major present challenge is development of low-cost facilities to convert this energy to useful forms. Two of the more attractive prospects for solar electricity, for example, are photovoltaic devices and steam or vapor engines operated from solar collectors. Costs, however, are prohibitive. Before any experimental effort is expended for generating electricity from solar heat, careful technical and economic analyses are required. The report discusses elements of the analyses, foreseeing more intensive research and development efforts.

### Technology Assessment With Special Reference to Energy

Cornell University, Center for Environmental Quality Management. C. L. Comar. October 1970. 40 pages.

**PB-228 863/GIX**

**PC \$3.75/MF \$2.25**

The long-term and short-term implications of society's need for energy are discussed in terms of the necessity to assess biological costs of energy production, the need to maximize benefits and minimize costs, and to discover the price society is willing to pay for the energy it wants or needs. Various aspects of energy production are covered, such as: Amount used per person; functional allocation; sources; available reserves; ultimate limits; increase in demand; heat disposal problems; radioactive wastes and the effects of air pollution. Comparative risk assessments are made between voluntary-involuntary actions as compared to risks of radiation from fallout and nuclear plants, along with cost in terms of risk of death versus financial benefit to the individual and the cost of deaths averted through medical and other programs. The need for logical decisions on the priorities and choices of options (based on cost-benefit analyses) is stressed, as is the need for guiding principles for reduction of environmental effects from energy production.

### High-Voltage Direct-Current Transmission

Cornell University, Center for Environmental Quality Management. Robert L. Shedden. January 1971. 24 pages.

**PB-228 885/GIX**

**PC \$3.25/MF \$2.25**

Transmission is an integral feature of satisfying demands for electricity and has its own environmental costs that must be taken into account. The growth of electric power interconnecting systems, the use of distant fuel sources, the need for economic power exchange, and varying load density patterns have all emphasized the need and opportunity for use and practical application of high-voltage transmission. Direct current has, therefore, become a pertinent factor affecting the planning of future power systems. This document presents a summary of the technical status of high-voltage direct-current electric power transmission throughout the world. Coverage varies from the first master D.C. link, which went into operation in Sweden in 1954, to the solid-state systems currently under design and construction. A sampling of the extensive bibliography on this subject is included.



## **Coal Gasification: A Review**

Cornell University, Center for Environment Quality Management. C. R. Aleta. November 1971. 37 pages.

**PB-228 887/GIX**

**PC \$3.75/MF \$2.25**

Coal gasification may be, under many circumstances, the best alternative to augment a natural gas supply. This document reviews some of the known methods of coal gasification—both underground in coal beds, and aboveground in physical plants. Particular attention is given to four promising aboveground techniques—Hygas, CO<sub>2</sub> Acceptor Gas Process, Bigas, and Synthane. Consideration is also given to the environmental effects of fuel gasification of coal.

## **Proceedings of the Bioconversion Energy Research Conference**

University of Massachusetts, Institute for Man and His Environment. June 1973. 128 pages.

**PB-231 149/GIX**

**PC \$5.75/MF \$2.25**

This document contains materials presented at a conference which was convened in June 1973 to consider the question of biological conversion of waste and livestock feedlot materials to methane. Included are summary statements of each principal speaker at the conference, together with a transcript of essentially all of the tape-recorded question-and-answer period that followed each presentation. The topics covered are: Methane fermentation as a potential fuel gas source; anaerobic digestion process of complex organic molecules; comparison of biochemical conversion processes with thermal oxidation processes for the recovery of resources from municipal solid waste; anaerobic processing of organic refuse for the purpose of obtaining methane; dynamic modeling and control strategies for the anaerobic digestion process; methane production from the anaerobic treatment of petrochemical industry wastewaters; digestion of animal wastes to produce methane; biological conversion of solar energy to the chemical energy of methane; management aspects of refuse bioconversion; use of thermophilic microorganisms to effect the digestion of waste for the production of methane.

## **The Total Flow Concept for Recovery of Energy From Geothermal Hot Brine Deposits**

University of California, Lawrence Livermore Laboratory. A. L. Austin, G. H. Higgins, and J. H. Howard. April 1973. 41 pages.

**UCRL-51366/GIX**

**PC \$3.00**

Of the available forms of geothermal energy, hot brine deposits have the greatest potential for development of a viable long range geothermal energy source. The recovery and conversion of the energy potential of these deposits require only moderate extensions of existing technologies. This report describes a new method for producing electrical power from this energy source. The method uses a "total flow" concept. Hot brine is allowed to expand to a wellhead on the surface. The thermal energy of the brine is converted to kinetic energy by expansion through a converging-diverging nozzle. The high velocity output is used to drive a modified hydraulic impulse turbine. Theoretically, this method should produce 60% more power than other hot brine systems, either operational or proposed. The basic advantage is that total flow would be used, allowing recovery of energy that would otherwise be lost. Use of the hydraulic impulse turbine is attractive since much of the

needed technology exists, the devices are inherently rugged, and fabrication with corrosion-erosion resistant materials is possible.

## **Environmental Technology**

### **Water Pollution From Erosion. A DDC Bibliography**

Defense Documentation Center. July 1973. 178 pages.

**AD-763 700/GIX**

**PC \$7.00/MF \$2.25**

This bibliography contains abstracts of reports on the presumably damaging deposition of earth materials in waters. Soil sediments are considered to be pollutants if they would seem to interfere with the use of water for navigational, recreational, agricultural, biological, or ecological functions. The reports listed were published during the period 1961 thru 1972. Subject and author indexes are included. All reports are the result of U.S. Government-funded research and all are available from NTIS.

### **Investigation of Rational Effluent and Stream Standards for Tropical Countries**

Asian Institute of Technology. Mainwaring B. Pescod. May 1974. 61 pages.

**AD-782 199/GIX**

**PC \$4.25/MF \$2.25**

The most important uses of surface waters in the developing countries of Asia are for fishing, irrigation, and potable water supply. Maintenance of proper quality and standards for these uses is a highly important responsibility of the regional development planners. The standards must neither be lax enough to destroy possible future use of a stream, nor so strict that excessive waste treatment is called for. The report discusses desirable standards vs. current quality standards in Asia with regard to irrigation, fishing, potable water, waste disposal, and minor uses of a stream. The effects are outlined of oxidation pond effluents, including experimental procedures and results, and oxygen production rates. An evaluation of wastewater treatment alternatives is made, involving the degree of treatment required, systems employed, and the comparative costs of the treatment systems.

### **Cadmium in the Environment: An Annotated Bibliography**

Oak Ridge National Laboratory. Emily D. Copenhaver, G. U. Ulrikson, L. T. Newman, and W. Fulkerson. April 1973. 444 pages.

**ORNL-EIS-73-17/GIX**

**PC \$24.25/MF \$2.25**

This document contains bibliographic citations and abstracts to more than 900 articles, papers, and reports concerning the occurrence and effects of cadmium in the environment. The entries are arranged according to the following categories: Reviews and bibliographies concerning cadmium; natural occurrence; mining and extraction; uses and consumption; pollution of air and water; chemistry; waste disposal; analytical methods and monitoring equipment; control and abatement; physiological and toxicological aspects in plants, animals, and man. Subject and author indexes are included.

### **Thermal Effects on Aquatic Organisms: Annotated Bibliography of 1972 Literature**

Oak Ridge National Laboratory, Environmental Sciences Division. Charles C. Coutant, and Helen A. Pfuderer. June 1973. 187 pages.

**ORNL-EIS-73-28/GIX PC \$11.50/MF \$2.25**

This bibliography contains more than 400 abstracts from the worldwide literature on thermal effects on aquatic organisms, with particular reference to the effects of heated effluents added to natural waters. The abstracts are arranged according to the following subject categories: Reviews on thermal effects; site studies; ecosystem producers; ecosystem consumers (reproduction and development, distribution, temperature tolerance, tissue and organ responses, growth, feeding, temperature and other stresses, activity, predator-prey relations); ecosystem decomposers; diseases; beneficial uses of waste heat. Subject and author indexes are included.

### **Oil Spillage: A Bibliography. Volume 1**

Water Resources Scientific Information Center. May 1973. 394 pages.

**PB-221 107/GIX PC \$10.25/MF \$2.25**

This bibliography contains more than 250 abstracts of publications dealing with all aspects of the spillage of petroleum oil on natural waters. Volume 1 covers the literature published thru 1970. Subject and author indexes are included.

### **Oil Spillage: A Bibliography. Volume 2**

Water Resources Scientific Information Center. May 1973. 452 pages.

**PB-221 108/GIX PC \$11.50/MF \$2.25**

This bibliography contains more than 290 abstracts of publications dealing with all aspects of the spillage of petroleum oil on natural waters. Volume 2 covers the literature published during the years 1971-72. Subject and author indexes are included.

### **Energy and the Environment: Electric Power**

Council on Environmental Quality. August 1973. 66 pages.

**PB-223 326/GIX PC \$4.25/MF \$2.25**

A discussion is made of the highly involved relationships between modern energy needs, sources, system waste products, and the environment. The focus is on electrical energy because of the particularly rapid growth in this sector. Some of the factors considered are air and water pollution, the consumption of a dwindling fossil fuel reserve, supply and demand factors, waste and effluent disposal, and management problems and policies. Trends are noted, along with the present search for substitute sources. Of special note is the forecasted development of nuclear power. Other possibilities include coal gasification, use of oil shale, natural and other gases, geothermal engineering, and solar energy applications. Consideration is given to transportation and home appliance needs. Comparisons are made with coal-fired systems.

### **Final Conference Report for the National Conference on Managing the Environment**

Washington Environmental Research Center. Robert W. Fri, Russell E. Train, et al. May 1973. 269 pages.

**PB-227 033/GIX PC \$8.50/MF \$2.25**

The complexity of environmental issues and trade-offs involved in achieving environmental quality necessitate an understanding of the various perspectives on the environment held by government, industry, business, citizens, economists, and ecologists.

Strategies for environmental management—such as techniques for citizen participation, management information systems, organizational structures, special regulatory procedures and controls, legal action, etc.—are in the process of being developed and tested as tools for the environmental manager. Furthermore, authorities and responsibilities of the different levels of government must be defined. Cooperation among governmental levels, industry, and citizens is essential for success in meeting the environmental challenge. For these reasons, the National Conference on Managing the Environment was conceived to address these problems and to open a dialogue between managers—public and private—on the environment and related issues. This report summarizes highlights of the conference and analyzes innovations in environmental management. Some of the topics covered are: Analysis of the complexity of the environment as a policy issue; various organizational approaches for managing the environment; citizen participation in environmental management; analysis of different strategies in environmental management; management information systems for environmentalists, with a summary and evaluation of specific decision-making models; interjurisdictional relations in environmental management.

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## **Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents**

National Environmental Research Center, Analytical Quality Control Laboratory. Cornelius I. Weber (Ed.). July 1973. 106 pages.

**PB-227 183/GIX**

**PC \$7.00/MF \$2.25**

The role of aquatic biology in a water pollution control program might include field and laboratory studies carried out to establish water quality criteria for the recognized beneficial uses of water resources and to monitor water quality. This manual contains what are considered to be the best available methods for use in routine field and laboratory work in fresh and marine waters. The major sections are as follows: Bio-metrics (study design, graphic examination of data, sample mean and variance, tests of hypotheses, confidence intervals or means and variances, linear regression and correlation); plankton (sample collection and preservation, sample preparation, sample analysis, biomass determination, phytoplankton productivity); periphyton (sample collection and preservation, sample preparation and analysis); macrophyton (sample collection and analysis); macroinvertebrates (selection of sample sites, sampling methods, sample processing, data evaluation); fish (sample collection, sample preservation, sample analysis, special techniques); bioassay (phytoplankton—algal assay, periphyton, macroinvertebrates, fish). Extensive bibliographic references are included.

## **Compendium of Analytical Methods—Volume 1: Matrix of Methods**

Mitre Corp. April 1973. 103 pages.

**PB-228 424/GIX**

**PC \$5.25/MF \$2.25**

A two-volume report draws together the descriptions of present analytical methods used in environmental protection laboratories. It is intended to assist in developing standardization in analytical methodology, and to provide management personnel with easily accessible information on methods which are available for measuring specific pollutants. A variety of applications are covered, from routine monitoring through research to recommended or officially selected procedures. Certain methods may be contraindicated for specific applications. For some pollutants several methods are cited, but there is no general attempt at classification according to use. Volume One contains a matrix of procedures with definitions and summary data. Included are methods for air, water and wastewater, drinking water supply, solid waste, radioactivity, pesticides, oil and grease, and biological processes. Each method is presented in two levels of detail, a form which relates the pollutant to the medium in which it occurs and the method used, and a method summary that applies the analytical method to a specific parameter, plus a statement of purpose and quantitative characteristics.

## **Compendium of Analytical Methods—Volume 2: Method Summaries**

Mitre Corp. April 1973. 379 pages.

**PB-228 425/GIX**

**PC \$10.25/MF \$2.25**

Volume Two of a two-volume report on environmental protection laboratory methods presents the important characteristics of various procedures in abstract form. It describes in each case the pollutant analyzed, the medium in which it occurs, and a nonquantitative summary of the measurement and detection technique. About 400 methods are included in the compendium, but there is no intent to provide the laboratory procedures themselves. Methods are categorized for air, water and wastewater, drinking water supply, solid waste,

radioactivity, pesticides, oils and greases, and biological methods. Instrumentation and data recording processes are also noted.

## **Some Prospects for Aquatic Weed Management in Guyana**

National Science Research Council of Guyana; and U.S. National Academy of Science. D. H. Irvine, Gerard A. Rohlich, et al. March 1973. 53 pages.

**PB-228 660/GIX**

**PC \$4.25/MF \$2.25**

A three-day workshop on the Management and Utilization of Aquatic Plants was held in Georgetown, Guyana, in March 1973 to formulate recommendations addressed to one of Guyana's critical problems—the weeds that infest the nation's waterways. This report contains the observations, findings, and recommendations of the workshop. It should be of interest to planners, agriculturists, and others in developing countries throughout the world who are faced with aquatic weed problems. Some of the topics covered are: Aquatic weeds found in Guyana and their effects on navigation, drainage, agriculture, fisheries, and public health; physical characteristics of aquatic plants, including chemical composition and productivity; biological control, including the use of fish, manatees, other vertebrates, insects, snails, pathogens, and competitive displacement; chemical control; aquatic weed use; dewatered aquatic weeds as animal feed; aquatic weeds as soil additives.

## **Glossary of Aquatic Ecological Terms**

Environmental Protection Agency, Air and Water Programs Division. John E. Matthews. February 1972. 62 pages.

**PB-229 803/GIX**

**PC \$4.25/MF \$2.25**

This glossary is intended to provide familiarity and understanding of English-language technical terminology specific to the discipline of aquatic ecology. The definitions have been carefully reviewed to assure accord with current professional usage. Terms specifically identifying or describing organisms are generally not included. A brief bibliography provides a list of glossaries in related disciplines and standard reference works in the field of aquatic ecology. The glossary will serve as a convenient reference for professionally trained personnel concerned with water pollution control.

## **Current Practices in Water Microbiology**

Environmental Protection Agency, Water Programs Office. Rocco Russomanno (Ed.). January 1974. 346 pages.

**PB-235-902/GIX**

**PC \$9.50/MF \$2.25**

This training and reference manual is designed for use by engineers, chemists, biologists, bacteriologists, and administrative personnel responsible for the planning and conduct of water pollution surveys. Subjects covered include: Bacteriological indicators of water pollution; bacteria and their survival in the aquatic environment; bacteriological pathogens in the aquatic environment; transmission of viruses by water; filamentous bacteria; water quality for recreation and aesthetics; water quality surveys; presentation and interpretation of bacteriological data; examination of water for coliform and fecal streptococcus groups; media and solutions for multiple dilution tube methods; use of tables of most probable numbers; most probable number theory; the membrane filter in water bacteriology; preparation of membrane filter equipment for lab use; membrane filter equipment for field use; principles of cul-



ture media for use with membrane filters; selection of sample filtration volumes for membrane filter methods; colony counting on membrane filters; verified membrane filter tests; determining acceptability of membrane filter methods in water quality tests; collection and handling of samples for bacteriological examination; recovery and identification of *Salmonella* and *Shigella* from environmental waters; testing the suitability of distilled water for the bacteriological laboratory; identification of fecal streptococci; introduction to statistics; ecology and sanitation of bivalves; contaminants of shellfish; development of bacteriological standards for shellfish growing areas; shellfish growing area surveys; biological aspects of natural self purification; biota of wastewater treatment plants; aerobic bacterial systems for industrial wastes; unit operations in waste treatment.

#### **Proceedings: Flue Gas Desulfurization Symposium—1973**

National Environmental Research Center. December 1973. 1140 pages.

**PB-230 901/GIX**

**PC \$29.25/MF \$2.25**

The primary purpose of the Flue Gas Desulfurization Symposium was to present the current status of "throwaway" and "regenerable" flue gas desulfurization processes as applied to controlling SO<sub>x</sub> emissions from full-scale facilities. The symposium included sessions on technology and application of first generation processes such as lime/limestone scrubbing, magnesium scrubbing, catalytic oxidation and sodium sulfite scrubbing as well as a session on second generation or advanced processes. In addition, a panel discussion was held concerning the disposal and uses of by-products from flue gas desulfurization processes. All papers presented (as well as transcriptions of the panel discussions and the symposium summary) are included in these proceedings.

#### **Processing, Chemical Composition, and Nutritive Value of Aquatic Weeds**

University of Florida. Water Resources Research Center. L. O. Bagnall, R. L. Shirley, and J. F. Hentges. November 1973. 58 pages.

**PB-231 207/GIX**

**PC \$4.25/MF \$2.25**

Disposal of harvested aquatic plants is one of the most serious problems with mechanical control systems. Disposal of reduced plant material in the water degrades water quality in the same way that present chemical control systems do. Disposal on the shore produces a pile which interferes with further removal. This report provides the results of a project which was undertaken to explore uses for the harvested aquatic plants, particularly for animal feed, and to develop processes for converting the raw plants to the most useful products by the most economical means. The plants of principal concern are water hyacinth (*Eichhornia crassipes*) and *Hydrilla verticillata*. Several mechanical processing devices are described, including a press capable of removing 75% of the water with a modest energy input. Consideration is given to methods of converting the plant material into livestock feeds, in the form of silage, concentrate, and pellets, and into horticultural compost. The nutrient and toxicological aspects of the processed plant products are discussed.

## **Food Science**

### **Alternative Sources of Protein for Animal Production. Proceedings of a Symposium**

National Research Council, Committee on Animal Nutrition; and American Society of Animal Science. J. E. Oldfield; W. M. Beeson, et al. June 1973. 184 pages.

**PB-224 427/GIX**

**PC \$7.00/MF \$2.25**

This document contains papers presented at a symposium which sought to examine some issues arising from the critical question of protein supplies needed to meet the food needs of the world's expanding human population; in particular, the fact that, in exploiting animal proteins for human consumption, sources of protein for animal production may, in turn, become limiting. In addressing this issue, the symposium explored measures for enhancing protein supplies from known proteinaceous feeds and then identified certain new sources. The specific topics covered include: Improvement of the quantity and quality of cereal grain protein; separation of protein from fiber in forage crops; developments in processing meat and blood by-products; advances in oilseed protein use; investigation of plants not currently used as major protein sources; technological developments in fish processing and implications for animal feeding; production of single-cell protein from solid wastes; recycling animal wastes as protein sources. (Paper copy is available only from: Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue N.W., Washington, D.C. 20418, U.S.A. Price: \$5.75. Microfiche copy is available from NTIS.)

### **Scientific Literature Reviews on Generally Recognized as Safe (GRAS) Food Ingredients—Glutamates**

Tracor-Jitco, Inc. February 1974. 579 pages.

**PB-229 856/GIX**

**PC \$13.25/MF \$2.25**

This report provides a review of available information relating to the safety of L-glutamic acid and its monoammonium monopotassium, and monosodium salts as food additives. Consideration is given to general chemical and physical properties; analytical methods; occurrence in nature and in foodstuffs; acute toxicity; implications in retinal lesions, brain damage, neuroendocrine disturbances, and nephrotoxic effects in laboratory animals; human toxicity; glutamates and the blood-brain barrier; studies on mutagenesis, teratogenesis, carcinogenesis, and therapy; physiological absorption; metabolism and excretion, effects on enzymes and other biochemical parameters; drug interaction; consumer exposure. A similar body of information is also provided for hydrolyzed protein. Included is a bibliography containing more than 8300 references to the worldwide literature on the subject. (For additional titles in the GRAS Series, see AMTID, February 1974, pages 57-61 and AMTID, August 1974, pages 34-35.)

### **Scientific Literature Reviews on Generally Recognized as Safe (GRAS) Food Ingredients. Adipic Acid**

Informatics, Inc. February 1974. 30 pages.

**PB-230 305/GIX**

**PC \$3.75/MF \$2.25**

This report provides a review of available information relating to the safety of adipic acid as a food additive. Consideration is given to general chemical and physical properties, analytical methods, occurrence, acute toxicity, short-term toxicity, teratogenicity, metabolism and excretion, and consumer exposure. A bibliography of GG entries is included.

## Scientific Literature Reviews on Generally Recognized as Safe (GRAS) Food Ingredients. Pectin

Informatics, Inc. February 1974. 54 pages.

**PB-230 306/GIX**

**PC \$4.25/MF \$2.25**

This report provides a review of available information relating to pectin as a food component. Consideration is given to chemical properties, acute toxicity, short-term toxicity, long-term toxicity, atherosclerosis studies, gallstone studies, anti-ulcer studies, and biochemical aspects. A bibliography of 493 entries is included.

## Highway Engineering

### Soil Compaction and Corrugations

National Research Council, Highway Research Board. K. Majidzadeh, H. Guirguis, et al. 1973. 68 pages.

**PB-222 569/GIX**

**PC \$4.25/MF \$2.25**

Uniform pavement subgrade support that will provide a more satisfactory riding surface is the objective of continuing research on soil compaction. Improvements in earthwork construction should be enhanced by the data contained in this report, with regard to compaction fundamentals, control curves, specifications, and evaluations. Six papers are presented. The first makes a correlation between engineering and physical properties of field-compacted and laboratory specimens. The next investigates oddly shaped compaction curves with respect to the effects of temperature, since irregular curves are often confusing to those who handle field compaction control. The third study develops the failure probability of linear elastic, heterogeneous embankments and suggests how the results can be incorporated into acceptance specifications. The following paper applies strain measurements to the evaluation of soil compactors, while the next one discusses the various factors that affect the calibration of nuclear moisture gages. The final report is a study of road corrugations, leading to maximum and minimum values of vehicle weight, tire pressure, and vehicle speed above and below which corrugation will not occur.

### Stabilization Procedures for Puerto Rico Low-Grade Soils

Puerto Rico Department of Transportation and Public Works, Research Division. Rene V. Batista and Antonio Castro Rosario. March 1973. 83 pages.

**PB-222 652/GIX**

**PC \$4.75/MF \$2.25**

Soil stabilization can be defined as soil improvement, which in its broadest sense is the alteration of any property of a soil to improve its engineering performance. The demand for roads capable of handling high wheel loads often results in a scarcity of sound construction materials with good engineering characteristics. In these cases stabilization may be more economical than conventional fill materials and, in many cases, may perform much better. This document is concerned with procedures used in Puerto Rico for the stabilization of low grade soils; namely, densification and chemical stabilization. Consideration is given to determining when soil stabilization is required; methods used for soil stabilization under various conditions; sampling and testing to determine how much of what method is to be used; stabilization procedures by means of densification, including compaction, dewatering, and preloading; procedures for chemical stabilization by means of asphalt, cement, lime, lime-cement, and the drill line technique.

### Structural Performance of Drainage Structures

National Research Council, Highway Research Board. Merlin G. Spangler, R. K. Taylor, et al. 1973. 60 pages.

**PB-222 875/GIX**

**PC \$4.25/MF \$2.25**

Four papers are presented on highway drainage structures. The first covers long-time measurement of loads on pipe culverts. Three 44-inch O.D. structures were studied during a 21-year period, one of concrete, one of cast iron, and one of corrugated steel, all under a 15-foot embankment. Theory, mathematical formulations, and observed data are documented. The second paper deals with an induced-trench method of culvert installation. During a 16-month period a reinforced concrete pipe was observed in a so-called incomplete trench, with pressure cells beneath it and a covering of selected materials. Results of theoretical and measured loads are compared. The third paper is an investigation of soil structure interaction for buried concrete pipe; the fourth discusses the computerized design of precast reinforced concrete box culverts. Detailed data are given on the technology of culvert design and construction, as well as the statistical relations involved.

### Traffic Signals

National Research Council, Highway Research Board. Charles E. Dare, Pierre-Andre Jomini, et al. 1973. 51 pages.

**PB-223 140/GIX**

**PC \$4.25/MF \$2.25**

The document is comprised of five papers that deal with traffic control devices, with special emphasis on signals. In the first, a signalized intersection is described as suitable for speed signal "funnel" installation using three variable message speed signals under traffic-actuated control. Estimates are given for the costs of equipment, maintenance, vehicle operation, time, and accidents. Economic desirability is determined by incremental benefit-cost ratios. Next, an optimal scheme is presented for coordinating consecutive signals along an arterial route or network, requiring the macroscopic analysis of traffic flow patterns. Such an analysis is reported for Toronto, Canada, using a digital computer to control the traffic lights. Third is review of a traffic signal progression program to maximize movement along a facility with multiphase signals. Real time control of an arterial pilot system is discussed. A special study follows dealing with color and arrow indications for traffic signals, with description of a controlled laboratory study. Lastly an analytic survey is made of some highway signing and sign maintenance inventory systems in Virginia. Indications are made for the need of more such inventories.

### Roadway Illumination Systems

Texas A&M University, Texas Transportation Institute. Neilon J. Rowan and Ned E. Walton. May 1972. 202 pages.

**PB-224 304/GIX**

**PC \$7.00/MF \$2.25**

During a rapid advancement in the technology of highway lighting, there is need to examine lighting practices continuously to assure that optimum results are being obtained. Thus an ongoing testing program is in progress covering new concepts, modified equipment, and innovations that may advance roadway lighting. High mast lighting, luminaires, and floodlights are examined. Discussions are presented on tests and evaluations of these systems, as well as materials on transitional lighting, safety lighting, driver visual behavior, and lighting cost effectiveness. Photometric data are given for the newer light sources, and comparisons are made with mercury vapor lamps. A technique for extrapolation of photometric data is given, and a relative hazard index is described for the use of luminaire supports in medians.



### **Managing Highway Maintenance: Training Guide and Catalog**

Roy Jorgensen Associates Inc. Clyde A. Burke. January 1973. 38 pages.

**PB-224 407/GIX**

**PC \$3.75/MF \$2.25**

A guide is presented for the use of highway department officials, maintenance engineers, and training officers, covering the management principles applicable to highway maintenance operations; training materials to meet the needs of field engineers, supervisors, and foremen; and a 17 unit curriculum which can be readily adapted to a number of uses. Incorporated are management concepts and practices of a number of highway maintenance agencies which have developed workable systems. The training is organized and sequenced by five broad areas: management problems, management by objective, work planning, work control, and management systems. One level is designed specifically for foremen or crew leaders; another is directed to intermediate supervisors; and a third is of use to field engineers. Training approaches are discussed, along with prerequisites, a consideration of who should take what training, and how to make modifications. Among the topics covered are self instruction, text and group discussions, lectures and workshops, and teaching materials.

### **Development of Guidelines for the Design of Subsurface Drainage Systems for Highway Pavement Structural Sections**

Harry R. Cedergren, Consulting Engineer; and Ken O'Brien and Assoc. Consulting Engineers. H. R. Cedergren, Jorge A. Arman, and K. H. O'Brien. February 1973. 208 pages.

**PB-231 173/GIX**

**PC \$7.25/MF \$2.25**

The damaging effect of water on road structural sections is well known to those involved in the design, construction, and maintenance of highways. Most of these damaging effects occur when free water gains access to the structural section and foundation soils, altering the mechanical properties of these materials by increasing the moisture content and allowing excess pore pressures to develop under impact of traffic. Free water reduces the frictional strength of structural section and foundation materials by creating buoyancy within these materials. The sources of water in roadbeds include rainfall infiltrating through joints, cracks, unpaved shoulders and pervious pavements; ground water movement; localized springs or seepages; moisture transfer within soil masses; and thermodynamic or hydrogenesis processes. Of all sources, surface water is the most prevalent. This document presents a series of guidelines for the design of effective subsurface drainage systems for highway structural sections. Primary attention is directed to controlling surface runoff infiltrating downward through roadway surfacing, pavement joints or cracks, and pavement shoulders. Consideration is given to a review of the worldwide literature related to subsurface drainage and associated subjects; water actions beneath pavements, including sources of water, points of entrance of water, factors preventing drainage, and effects of excessive water; case investigations of various drainage situations; design, construction, and maintenance of subsurface drainage systems; cost/benefit analyses.



**Comer Heine of the National Technical Information Service explains the input processing system to members of the International Federation of Library Associations in Washington, D.C. for the November annual meeting.**

### **Small Industry Development in Ecuador**

The following information was included in an address presented by Victor D. Martínez C., Head of Servicio de Información Técnica, Centro De Desarrollo Industrial Del Ecuador (CENDES) Guayaquil, Ecuador at the OCED meeting on Low Cost Technology held in Paris in September 1974.

Historically, developed countries started on a small scale and slowly expanded. However, the newly developing nations of the 20th century have a potential time advantage in the sense that they can condense generations of developmental history into a few decades. They can do this by drawing on the technical resources and knowledge of the developed world to hasten their own industrialization.

The evolution of small Ecuadorian industry has been delayed principally because of the lack of a general policy of coordination and development in this sector. The major factors identified are:

- Lack of an appropriate economy
- Deficient management practices
- Lack of market knowledge
- Low productivity
- Deficient technologies

It is important to implement the actions of technological information transfer mechanics, and the efforts of technical assistance at the plant level, to permit creation of conditions necessary for dynamic development of this sector.



## **An Information Policy for the Development of Small Industry**

Basic in this sense is the formulation of incentives for the creation of a small industry advisory service to provide technical information on processes, machinery and raw materials, as well as coordination of basic research services and marketing assistance.

Functions that can be performed by regional technical information services for small-scale industries can generally be grouped as follows:

- Collection and dissemination of economic and technical information, particularly that which is related to the identification and study of small industrial plants or artisan workshops which are economically feasible for establishment within the region.
- Application of new technologies or adaptation of technologies utilized in other regions.
- Standardization and quality control.
- Specialized technical counseling, relating to processes, organization, programming, layout, design, working methods, etc.
- Management assistance and marketing assistance.

A service like this is best equipped to handle these functions, in the first place, because it can appreciate and analyze the general situation affecting the region as a whole. This objectivity is important in the evaluation of the needs and development possibilities of the regional industrial sector vis-a-vis available resources, and established local interest.

The above is especially the case in, for example, the identification of new investment opportunities or the evaluation of existing projects, the dissemination of technical information, and application of technologies from other regions.

Especially in the case of dissemination of technical information and application of new technologies, the process of previous study, selection, testing and dissemination requires substantial financial resources and highly qualified technicians and experts.

## **The CENDES Technical Information Service**

The work of the CENDES Technical Information Service is important in the promotion of new industrial projects, and also for the rationalization of production of installed plants.

The dissemination of the basic technical information realized by CENDES operates on the following fields:

Technical information for rationalization of production.

Identification of possible industrial opportunities of easy implementation.

Evaluation of technological alternatives.

Assistance in the elaboration of feasibility studies.

Creation of an infrastructure between the university, private enterprise and the state government sector.

In March, 1973, this department began with the Technical Inquiry Section, and since then CENDES' Technical Information Service has answered 539 requests, which can be classified as follows:

Industrial Applications	31.16%
Project Identification	22.44%
Market Information	14.10%
University	9.30%
Inter-Institutional	23.00%

The Technical Information Service is becoming a dynamic element and catalyst in the development of small industry. The practice of technical assistance transfer of information to other state institutions has made it possible to establish joint programs of coordination with a high multiplier effect tending in the future to the establishment of a national information network.

## Industrial Processes

### Testing Methods and Techniques: Environmental Testing. A Compilation

National Aeronautics and Space Administration, Technology Utilization Office. 1971. 25 pages.

**N72-14453/GIX**

**PC \$3.25/MF \$2.25**

Many technological developments that have been accomplished by or for NASA have potential utility outside the aerospace industry. This compilation describes a variety of such devices and techniques for testing hardware and components in four special environments—low temperature, high temperature, high pressure, and vibration. The innovations vary from an automatic calibrator for pressure transducers to a fixture for testing the susceptibility of materials to ignition by electric spark. The items included in the compilation were selected for their potential value in terms of improved quality control, cost savings, or more realistic simulation of actual environmental conditions. Most of the innovations are free from patent restrictions, and information is provided concerning the availability of more detailed technical information on each item.

### Testing Methods and Techniques: Strength of Materials and Components

National Aeronautics and Space Administration, Technology Utilization Office. 1971. 26 pages.

**N72-18899/GIX**

**PC \$3.75/MF \$2.25**

Many test methods and techniques developed by or for NASA have potential applications outside of the aerospace industry. This compilation describes a number of such methods, techniques, and devices for testing the mechanical properties of various materials. Although metals and alloys are featured prominently, tests on a variety of other materials, from concrete to plastics, are also described. The approaches presented can result in considerable cost saving and quality control. The compilation is comprised of two sections: The first deals specifically with materials strength testing; the second treats the special category of fracture and fatigue testing. Most of the items described are free from patent restrictions. This publication is intended primarily for mechanical engineers and materials testing technicians; it may also serve as an introduction to the field to those unfamiliar with the principles and practices of materials testing.

### Testing Methods and Techniques: Testing Electrical and Electronic Devices

National Aeronautics and Space Administration, Technology Utilization Office. 1972. 27 pages.

**N72-19515/GIX**

**PC \$3.75/MF \$2.75**

Many technological developments that have been accomplished by or for NASA have potential utility outside of the aerospace industry. This compilation gives descriptions of a number of such developments that relate to the testing of electrical and electronic apparatus. The items described vary from semiconductor package leak detectors to automatic circuit analyzers and antenna simulators for system checkout. In many cases, the approaches presented can result in considerable cost savings, together with improved quality control. The compilation is presented in three sections. The first describes the testing of various electronic components, assemblies, and systems; the second treats the testing of various electrical devices; the third deals with the testing of cables and connectors. Most of the items are not subject to patent restrictions. Information is pro-

vided concerning the availability of more detailed technical information about each innovation.

### Development of the Weld-Braze Joining Processes

Langley Research Center (NASA). Thomas T. Bales, Dick M. Royster, and Winfrey E. Arnold, Jr. June 1973. 40 pages.

**N73-24573/GIX**

**PC \$3.75/MF \$2.25**

A new joining process is described which combines the use of resistance spotwelding with brazing. The process has been designated "weld-brazing." Test results obtained from single-overlap titanium alloy shear specimens joined with aluminum braze have shown that weld-brazed joints are substantially stronger than similarly brazed or spotwelded joints at temperatures ranging from ambient to 560°K. The strength of the weld-brazed joints is approximately equal to the sum of the values obtained from brazed-only or spotwelded-only specimens. In fatigue, braze-welded specimens are capable of carrying 3 times the load of similar spotwelded specimens. Compression tests have shown that weld-brazed specimens have maximum strengths 1.46 to 1.54 times higher and buckling strengths 1.6 to 2.25 higher than equivalent riveted specimens. In general, weld-brazing offers a substantial increase in structural efficiency over more conventional joining techniques. The simplicity of the process compared with brazing or riveting offers economic advantages which may make it cost effective on a production basis. Although the process has only been used to join titanium alloy with aluminum braze, braze-welding may be adaptable to other material systems where both brazing and spotwelding techniques are viable methods for joining.

### Engineering Control of Welding Fumes

Southwest Research Institute. Wm. J. Astleford, and James W. Register. July 1973. 122 pages.

**PB-223 113/GIX**

**PC \$5.25/MF \$2.25**

Results are provided of an investigation intended to define some satisfactory criteria for the control of welding and cutting fumes. Eight test matrices represented various combinations of common procedures, base metals, and electrode systems. Processes included manual metal, submerged, and gas shielded arc welding, air-carbon arc gouging, and oxyacetylene cutting. The base metals were uncoated carbon, low alloy, and stainless steels. Environmental conditions were intended to represent indoor, small scale, job shop production operations in an unconfined space. Breathing level fume samples for each combination were collected using water impingement techniques, and analyzed by atomic absorption spectrophotometry. The criterion for assessing fume hazard potential was the margin by which the breathing level data exceeded unity, representing the exposure threshold. Various methods of local exhaust ventilation were then screened to assess their ability to provide the desired fume control. A cross draft ventilation table was developed, a low volume-high velocity fume extracting welding gun was evaluated, and a free standing rectangular hood was used. The results are discussed with regard to a suitable margin of safety.

### Sputter Deposition and Ion Plating Technology

Sandia Laboratories, Thin Film Division. D. M. Mattox. June 1973. 51 pages.

**SLA-73-619/GIX**

**PC \$4.75/MF \$2.25**

Sputtering is the ejection of atoms from a surface by momentum transfer from high energy particles bombarding the surface; sputter deposition is the formation of a film by condensation of the ejected atoms. Sputter deposition has a num-



ber of unique advantages over other film-forming and coating processes. Ion deposition is a term applied to atomistic film deposition processes in which the substrate surface is subjected to a flux of high energy ions sufficient to cause appreciable sputtering before and during film formation. The chief advantage of this process is its ability to produce good adhesion between the film and the substrate surface. This document provides an introduction to the technology of sputter deposition and ion plating. It reviews the theory of gas discharges and sputtering which are relevant to deposition technology. Several special deposition configurations are described, and process development and control techniques are outlined.

### **Reduction of Machine Tool Spindle Growth**

University of California, Lawrence Livermore Laboratory. J. B. Bryan, R. R. Donaldson, R. W. Clouser, and H. W. Blewett. March 1973. 23 pages.

**UCRL-74672/GIX** **PC \$3.00/MF \$2.25**

Thermal errors in machine tools are typically several times larger than mechanical errors, and since machine temperatures change slowly over a period of hours, they give a machine tool the appearance of having nonrepeatable mechanical errors. Frictional heat generation in the spindle unit is the largest source of thermal distortion in machine tools such as lathes and mills. The largest resulting thermal error is axial spindle growth. This document describes a method of reducing machine tool spindle growth by forcing a large flow of temperature-controlled oil directly through the rolling element bearings of the spindle. Tests have shown approximately a five-fold reduction in both spindle growth and warm-up in lathes retrofitted with temperature control systems.

### **Machining and Gaging Information: 1972 Annual Index**

Union Carbide Corp., Machining and Gaging Information Center. A. M. Reed, and Debbie S. Beaver. July 1973. 143 pages.

**Y-SC-75/GIX** **PC \$9.25/MF \$2.25**

This document contains bibliographic citations and abstracts for more than 400 technical journal articles, papers, reports, and monographs that contain information which pertains to the high accuracy, close tolerance aspects of machining, dimensional measurement, and gaging. Subject, personal author and corporate author indexes are included. (For previous editions see AMTID, April 1973, page 72; and AMTID, July 1971, page 51.)

## **Materials**

### **Fabrication of Novel Composites. Part 2: Fabrication and Properties of Ba-Mica/ $Al_2O_3$ Composites**

Army Materials and Mechanics Research Center, Ceramics Research Division. James W. McCauley. May 1973. 24 pages....

**AD-762 839/GIX** **PC \$3.25/MF \$2.25**

Design engineers have been reluctant to utilize ceramic materials for many potential applications because of their brittle characteristics and inflexibility of properties. In this report a new but proven concept of material is described by which various properties can be easily adjusted, and which will permit designers new degrees of freedom in meeting complex engineering requirements. By this technique materials can be designed especially for the particular application. In particular,

it is shown how lamellar ceramic-based composites with controllable and easily modified properties may be fabricated by reactive hot pressing gamma- $Al_2O_3$  with Ba-mica. (Part 1, AD-742 207, is described in AMTID, January 1973, page 18.)

### **Thermally Stable Ethylene-Propylene Elastomers**

Air Force Materials Laboratory, Elastomers and Coatings Branch. Kermon Murray. November 1971. 48 pages.

**AD-890 107/GIX** **PC \$4.25/MF \$2.25**

This report describes the formulation and properties of a new series of ethylene-propylene vulcanizates which have extended heat and oxidation resistance at 400°F. Thermal stabilization is achieved by blending the basic terpolymer with a chloroprene polymer. This stabilization is enhanced by a combination of magnesium oxide and zinc oxide. The addition of a combination of antioxidants in optimum quantities provides sufficient oxidation protection to permit a 60% retention of tensile strength and elongation after exposure to 400°F for 48 hours. This represents nearly a threefold improvement over previously available ethylene-propylene compounds.

### **Moisture Effects on Thermoset Molding Compounds**

Bendix Corp., Kansas City Division. J. M. Conway. March 1973. 19 pages.

**BDX-613-821 (Rev.)/GIX** **PC \$3.00/F \$2.25**

The effects of moisture in thermosetting molding compounds are known to be related to many problems associated with processing variations. Inconsistent shrinkage and partial cure are examples. Moisture is also suspected of being a factor in the deterioration of the mechanical and electrical properties of molding compounds. This paper reports the results of a study of the effects of moisture absorption on three types of molding compounds: A mineral filled epoxy; a cotton filled phenolic; and a long glass fiber filled diallyl phthalate resin. The results confirmed that the mechanical and electrical properties of epoxy- and phenolic-based moldings deteriorated substantially when the raw materials were exposed to humidity at 25°C. Specimens molded from diallyl phthalate experienced limited degradation of physical properties, and then only when exposed to high relative humidity.

### **Glass-Polymer Composites**

Brookhaven National Laboratory, Department of Applied Science. Morris Beller, and Meyer Steinberg. January 1973. 25 pages.

**BNL-17555/GIX** **PC \$3.00/MF \$2.25**

A new class of structurally strong and durable composite material is described. This material, glass-polymer composite (GPC), is produced by mixing crushed waste glass with monomer (either methyl methacrylate or polyester-styrene) and polymerizing by chemical initiation techniques. The strength of GPC is two to four times higher than ordinary concrete. The durability, especially the resistance to chemical attack, far exceeds concrete. Bricks have been made from the material which are more durable and potentially more attractive than conventional brick. Sewer pipe has also been produced from GPC and is being tested in an urban sewage system. Other potential uses include structural and architectural forms for buildings, and acid-resistant tanks and reactors for the chemical industry. This document gives consideration to the formulation and polymerization of GPC, its properties, the fabrication of GPC pipe, and an economic evaluation.



### **Grading of Concrete Aggregates**

National Research Council, Highway Research Board. S. D. Baker, L. A. K. Bloy, et al. 1973. 132 pages.

**PB-223 004/GIX**

**PC \$5.75/MF \$2.25**

Mineral aggregates constitute about 75% of the total volume of concrete. Accordingly, considerable financial commitment is made to quality control, grading methods, and particle composition. In addition, challenges are periodically made to the accepted practices in grading. The report contains a group of papers aimed at updating these practices. Three of them deal with gap grading of aggregates both in actual construction and in the laboratory. Means of avoiding or reducing pavement cracking are discussed. Statistical and graphic methods are presented for the computation of blending proportions. The internal structure of concrete is studied, involving the measurement of mortar layer intercepts between coarse aggregate particles in the hardened product. Grading is related to drying shrinkage and tensile properties of lean mixtures, termed cement-treated base materials. Recent laboratory data assess the changes in certain concrete properties that result from fluctuations in aggregate grading in the field.

### **Predicting Segregation of Wood and Bark Chips by Differences in Terminal Velocities**

Department of Agriculture, North Central Forest Experiment Station. John A. Sturos. 1973. 8 pages.

**PB-224 068/GIX**

**PC \$3.25/MF \$2.25**

Fuller use of tree resources is desired to meet the anticipated demands for pulpwood. One method in this direction is to chip the tops and limbs presently left as residue in log harvesting. Another is to chip a whole tree. In either case, removal of the bark after chipping presents a problem, involving separation of the attached bark from the wood chips by breaking the wood-bark bond, and separating the bark chips from the wood chips. Air flotation is one process being investigated to segregate the bark from the wood. In falling through the air after separation, the wood and bark chips attain different terminal velocities, providing the segregation means. The report presents some information on eight important pulpwood species with regard to dimensions, moisture content, specific gravity, and terminal velocities for wood and bark chips. Indications are made for the prediction of segregation possible by such air flotation.

### **Asphalt and Asphalt Mix Technology**

National Research Council, Highway Research Board. Douglas Anderson, E. O. Busby, et al. 1973. 136 pages.

**PB-228 662/GIX**

**PC \$5.75/MF \$2.25**

The papers in the report are directed to asphalt materials researchers and practicing highway engineers concerned with asphalt pavements. They cover a wide variety of subjects including asphalt properties as related to pavement performance, the determination of asphalt content for paving mixtures, hot storage, failure mechanisms, mineral fillers, and the preparation of laboratory specimens. Data are presented on viscosity, penetration, and ductility. Rheology measurement and temperature susceptibility receive considerable attention. A discussion is given of crack development analysis. A laboratory procedure for fabricating asphalt-concrete beam specimens is described. The results of uniaxial compression creep tests under various loading conditions are presented. One study covers the storage of bituminous concrete in inert gas. Another deals with asphalt content determination using nuclear techniques.

### **Behavior of Shrinkage-Compensating Concretes Suitable for Use in Bridge Decks**

University of Illinois, Department of Theoretical and Applied Mechanics. Kim E. Seeber, Donald L. Bartlett, and Clyde E. Kesler. June 1973. 68 pages.

**PB-228 982/GIX**

**PC \$4.25/MF \$2.25**

The intent of this report is to provide a useful background on shrinkage-compensating cement concrete mix design variables. Research studying the behavior of shrinkage-compensating cement concretes in the laboratory was conducted using a standard bridge deck mix design in order that adaptation to field use would be simplified. The report also relates the findings of research conducted on the behavior of various shrinkage-compensating cement concretes subjected to different admixtures, curing procedures, and magnitudes of restraint. Strength and slump loss characteristics, the effects of mixing time and storage conditions on expansion, and the resistance to scaling due to freezing and thawing cycles are also presented.

### **A Study of the Effectiveness and Acceptability of Flame Resistant Fabrics**

Consumer Product Safety Commission. January 1974. 103 pages.

**PB-229 502/GIX**

**PC \$5.25/MF \$2.25**

The use of flame resistant fabrics in clothing and interior furnishings may afford the maximum practical potential for reducing serious burn injuries. Deaths and injuries from suffocation or asphyxia and property losses from small home fires can be reduced in number and severity by a wide use of such materials. A substantive base of information on the merits of such fabrics may serve as an impetus and a guide to the manufacture and use of flame resistant fabrics. This report provides the results of a study which was designed to provide a wide range of data on significant characteristics of currently available flame resistant materials and finishes. The study was undertaken in a major southern U.S. hospital, and evaluations were based on subjective and objective reports from the hospital patients and staff. The materials selected for the study included sheets, pillow cases, bedspreads, blankets, mattress covers, cubicle curtains, and patient gowns. Plain cotton was used as the control element. The flame resistant fabrics were inherently flame resistant synthetics and cotton and cotton-blends treated with one of three flame retardants. The results demonstrated the importance of adequate initial flame retardant treatments and of particular laundry chemistry to preserve the flame resistant properties of fabrics. The reactions of hospital patients and personnel to the test materials were overwhelmingly favorable.

### **Initial Development of Polymer Shotcrete**

Bureau of Reclamation, Concrete and Structural Branch. R. W. Nichols. January 1974. 19 pages.

**PB-229 946/GIX**

**PC \$3.25/MF \$2.25**

Shotcrete is a mortar or concrete conveyed thru a hose and pneumatically projected at high velocity onto a surface. A limited program was initiated on the potential use of polymer concrete for shotcrete application. Polymer shotcrete is similar to conventional shotcrete except that a polymeric binder is used in lieu of portland cement and water. The program included development of a rapid curing polymer-shotcrete

material, application techniques, and modification of conventional shotcrete equipment. The program has shown that polymer shotcrete can be successfully applied using modified conventional shotcrete equipment. Polymer shotcrete has several important advantages over conventional portland cement shotcrete and should have a number of applications in areas in which the important properties of polymer shotcrete—rapid cure, development of high strength in minutes, and excellent durability—would provide definite benefits. The polymer-shotcrete program has progressed to the point where limited field applications are possible.

#### **Utilization of Phosphorus Furnace Slag in Ceramic Wall and Floor Tile**

Bureau of Mines, Salt Lake City Metallurgy Research Center. E. G. Valdez, K. C. Dean, and L. L. Warner. 1974. 15 pages. **PB-231 179/GIX PC \$3.25/MF \$2.25**

During the refining of phosphate rock by the electric furnace technique, silica rock is added as a flux. The silica combines with impurities in the phosphate rock to produce a slag which presently has no commercial value and which constitutes a disposal problem. This document describes a process by which the slag may be used as a raw material for producing wall and floor tile. The effects of process variables such as forming pressure and sintering pressure are shown. The tiles are readily glazed to a smooth shiny finish. The cost of producing wall tile by this method compares favorably with the retail market value for similar wall tile. Commercial grade floor tile is produced by the addition of borax or other additives to the ground slag prior to processing.

#### **Paint Characterization by Electrical Techniques**

Georgia Institute of Technology, Engineering Experiment Station. W. R. Tooke, Jr., D. R. Hurst. November 1973. 72 pages. **PB-231 243/GIX PC \$4.25/MF \$2.25**

The electrochemical character of corrosion indicates that electrical properties and methods of testing should be appropriate for evaluating the performance capabilities of metal protective paint systems. Accordingly, a detailed examination was made of electrical capacitance and polarization methods of characterizing metal protective paints. The methods are described in this report. The theory underlying the methods and examples of their application are also given. The electrical capacitance technique provides a rapid means of obtaining information about moisture permeation of paint films. However, the precision of the technique is sufficient only for the broad classification of films. The electrical polarization technique provides information about the corrosion inhibitive characteristics of paint. The method appears to be useful for developmental work and for assessing weathering effects on films.

#### **Polymeric Materials for Underground Support**

Bureau of Mines, Spokane Mining Research Center. J. C. Franklin, J. E. Fraley, R. E. Burnham, and L. W. Brandt. 1974. 19 pages.

**PB-231 275/GIX PC \$3.25/MF \$2.25**

The rock structure surrounding a mine opening characteristically contains in-situ fractures, which provide natural failure initiation points. In bedded deposits, the in-situ cracks are usually preferentially oriented parallel to the laminate structure of the rock, due to shear stresses, or in a normal direction due to bending stresses. If these cracks can be bonded together, the rock opening can become a self-supporting structure with properties similar to the original unfractured material. Epoxy-based materials have now been developed which appear to

fulfill this function. Test results with these materials showed that bonded fractures in mine-roof strata were stronger than the virgin rock. Further tests showed that polymeric materials have good potential for bonding, and in conjunction with polymer roof bolts, are expected to result in an economic and useful new support concept.

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## Mining & Minerals Industries

### Nuclear Analysis in Geology and Geochemistry

Australian Atomic Energy Commission. E. A. Newland. March 1973. 117 pages.

**AAEC/LIB/BIB-378/GIX PC \$8.00/MF \$2.25**

This bibliography is comprised of references to the literature dealing with the application of activation analysis and other nuclear analytic techniques to geology and geochemistry. A separate section covers nuclear borehole logging. The period covered is 1967 thru 1972.

### Minerals Yearbook 1971. Volume 3, Area Reports: International

Bureau of Mines. 1973. 1088 pages.

**PB-227 843/GIX MF \$2.25**

This volume is one of a series that is intended to provide a statistical record on worldwide mineral industry during 1971, and that contains sufficient background information to interpret the year's developments. Volume 3 presents mineral statistics for more than 130 countries, not including the United States, and discusses the importance of minerals to the economies of these nations. A separate section gives an overview of the importance of minerals in the world economy. (Paper copy available only from: U.S. Government Printing Office, Washington, D.C. 20402, U.S.A. Price: \$10.00. Microfiche copy is available from NTIS.)

### Process Optimization Study of Non-Sparking Titanium Diboride Tool Materials

ManLabs, Inc. L. Kaufman, and R. L. Pober. October 1973. 23 pages.

**PB-229 485/GIX PC \$3.25/MF \$2.25**

Among the hazards of coal mining operations are the ignitions which occur during cutting. These ignitions may result when tool bits employed for cutting strike sandstone, sulfur balls, or other singularities in a flammable environment. The source of ignition may be the sparks generated during impact. Previous work resulted in the finding that titanium boride composites are promising nonsparking materials for use as cutting tools. This document provides the results of a study which was carried out to optimize the properties and performance of TiB<sub>2</sub>-Cu-Ni composites thru variations of composition, temperature, and processing conditions. The best results, in terms of lack of incendivity, hardness, impact strength, and bend strength, was a material containing 85 weight percent (w/o) TiB<sub>2</sub>, 12 w/o Cu, and 3 w/o Ni which was hot pressed at 2650F and 3000 psi.

### Mine Communications. Proceedings: Bureau of Mines Technology Transfer Seminar, March, 1973

Bureau of Mines. 1974. 90 pages.

**PB-231 135/GIX PC \$4.75/MF \$2.25**

The U.S. Bureau of Mines communications research program includes work on projects encompassing the field of mine communications and monitoring. This document contains papers which were presented at a seminar which was organized to provide the coal mining industry with detailed information about recently developed equipment, instruments, and techniques for use in mine communication systems. The topics covered include: Overview of developments in emergency and nonemergency communications; system for paging key individual miners wherever they may be; two-way communications with face machine operators; two-way communications with roving-miners; interconnecting new communications to existing systems.

### Ground Control Aspects of Coal Mine Design—Proceedings: Bureau of Mines Technology Transfer Seminar, Lexington, Kentucky, March 6, 1973

Bureau of Mines. 1974. 142 pages.

**PB-231 286/GIX PC \$5.75/MF \$2.25**

A major problem in moving a newly developed technology from its laboratory and demonstration phases into active industrial use is how to show potential users the benefits that can be gained thereby. The report presents a number of papers dealing with the design of coal mines, involving problems in panel design, mine roofs, longwall characteristics, and equipment. The material was intended to provide the coal mining industry with detailed information about recently developed techniques, machinery, and instruments which may be used in solving these problems. Some of the topics on mine ground control included are stress fields, in-situ determinations, subsidence rate effects on transfer of overburden weight, evaluation of room and pillar design, multiple entry design, geologic guidelines, natural jointing and coal mine stability, roof stability, and roof and floor bearing capacity tests.

### Structural Analysis of a Coal Mine Opening in Elastic, Multilayered Material

Bureau of Mines, Denver Mining Research Center. Fun-Den Wang, David M. Ropehan, and Meng-Cherng Sun. 1974. 40 pages.

**PB-231 298/GIX PC \$3.75/MF \$2.25**

Consideration is given to the identification of the major factors involved in controlling the caving of coal mine roofs, and on establishing guidelines for the structural design of underground mines. Of particular concern is the stress distribution around a rectangular opening in a homogeneous isotropic material. Finite element structural analyses are discussed as a means of determining the stress displacements and distributions around a single coal mine opening in a multilayered rock system. The effects of changes in mechanical properties of roof and coal layers, roof layer and mine opening geometry, horizontal to vertical load ratio, and structural geologic features on stress characteristics about the opening are studied. Variability in the stiffness and relative thickness of the immediate roof layers is compared to that for a homogeneous material. A high speed digital computer was used in the analyses, and where possible, the results have been compared with previous analytical solutions.

### Hydroexplosive Mining: A Method for Developing Deep, Thick Seams of Coal

University of California, Lawrence Livermore Laboratory. Paul B. Archibald. March 1974. 18 pages.

**UCRL-51520/GIX PC \$4.00/MF \$2.25**

Many coal deposits are too deep to be developed by surface mining and too thick to be fully exploited by present underground mining methods. Hydro-explosive mining, described in this document, may be one way to develop these deposits. The method involves drilling a hole into a coal seam and filling it with water. Over a period of time, small explosive charges are detonated in the bottom of the hole to fracture the coal. The water transmits the shock wave to the surface of the hole to fracture the coal. The loose coal, suspended in water, is brought to the surface with a pump. Although this document focuses on deep seams, hydroexplosive mining can also be applied to shallow deposits where it is desirable to leave the surface relatively undisturbed.



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### **Area Handbook for the Malagasy Republic (First Edition)**

American University. Harold D. Nelson, Margarita, Dorbert, et al. 1973. 334 pages.

**AD-765 293/GIX**

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Few recent works offering a comprehensive explanation of the various elements of Malagasy society have been published in the English language. This handbook, therefore, seeks to provide a compact and objective exposition and analysis of the Malagasy Republic's (Madagascar's) dominant social, political, and economic aspects. It is designed to provide an understanding of the forces operating within a developing country. The major topics covered include: General character of the society; historical setting; geography and population; ethnic groups and languages; the social system; living conditions; education; the arts and sciences; the governmental system; political dynamics and attitudes; foreign relations; mass communications; character and structure of the economy; agriculture and industry; national security. An extensive bibliography is included. (Paper copy is available only from: U.S. Government Printing Office, Washington, D.C. 20402, U.S.A. Price: \$3.85. Microfiche copy is available from NTIS.)

### **Area Handbook for the Republic of Turkey**

American University. Richard F. Nyrop, Ahmet O. Evin, et al. 1973. 424 pages.

**AD-776 581/GIX**

**MF \$2.25**

This handbook provides a convenient compilation of basic facts about the social, economic, political, and military institutions in the Republic of Turkey. The emphasis is on an objective description of the nation's present society and the kinds of possible or probable changes that might be expected in the future. The major topics covered include: General character of the society; historical setting; geography and population; ethnic groups and languages; religious life; social system; education; artistic and intellectual expression; mass communications; the governmental system; political dynamics and values; foreign relations; character and structure of the economy; agriculture and industry; trade and services; public order and internal security; the armed forces. An extensive bibliography is included. (Paper copy available only from: U.S. Government Printing Office, Washington, D.C. 20402, U.S.A. Price: \$5.90. Microfiche copy is available from NTIS.)

### **Space Among Us: Some Effects of Space Research on Society**

Goddard Space Flight Center (NASA). Charles P. Boyle. June 1973. 140 pages.

**N73-23968/GIX**

**PC \$5.75/MF \$2.25**

Actions in any area will inevitably have second-order consequences. These consequences are frequently of greater importance than the original actions. This is especially true of technical innovations. They recurrently produce second-order social, economic, and political changes that were neither intended nor anticipated. A number of organizations are now actively considering the wide range of effects, favorable and unfavorable, which may result from the space program. The beneficial effects are more easily anticipated than the undesired because in most instances they will be planned for. In some areas effects are already being reported. In others prediction is active but unavoidably speculation. This document reports on effects that have occurred, that are probable, and that seem possible.

### **Migration and Fertility: A Study of the Social Factors Involved**

Oak Ridge National Laboratory, Urban Research Section; and Oak Ridge Population Research Institute. P. Neal Ritchey. April 1973. 58 pages.

**ORNL-UR-101/GIX**

**PC \$5.00/MF \$2.25**

The universality of major changes in patterns of human reproductive behavior accompanying shifts in the agricultural-industrial economic dependence of populations is fairly well accepted. Fertility generally declines as urbanization proceeds and as agriculture and other rural activities become of lesser importance. In part, the decline is brought about by an apparent reduction in fertility among people of rural background who migrate to cities. Social factors mediate the extent to which migrants alter their behavior after coming in contact with the population in their destination area. The first section of this report reviews rural and urban fertility trends and migration between these areas in the 20th century. Current theories of migration and fertility are also reviewed. The main portion of the document is devoted to an explanation for the alteration in fertility accompanying environmental shifts. It examines the relationships between certain social factors, rural-urban and urban-rural migration, and numbers of children born to women of childbearing ages.

### **Effects of Crowding and High Population Density: An Annotated Bibliography**

Oak Ridge National Laboratory, Urban Research Section and Environmental Information Systems Office. Margaret M. Williams, Zell Combs, and Gill Edmonds. June 1973. 141 pages.

**ORNL-UR-112/GIX**

**PC \$9.25/MF \$2.25**

This bibliography contains more than 400 citations with abstracts, from the literature published during the period 1958 thru mid-1972, concerning the effects of crowding and high population densities on humans and other mammals. Emphasis is given to literature describing some demonstrable effect, rather than to speculative or purely theoretical writings. These effects fall into nine categories that form the basis of the chapters of the bibliography: general effects; effects described in terms of future planning; physical disease; psychiatric disease; education; human behavior; animal behavior; physiology; and population dynamics-mortality-fertility. Subject, author, and taxonomic indexes are included.

### **Pakistan Government and Administration: A Comprehensive Bibliography**

Colorado State University. Garth N. Jones. March 1971. 115 pages.

**PB-228 256/GIX**

**PC \$5.25/MF \$2.25**

This bibliography contains 1239 references to the literature on Pakistan government and administration. Major divisions of the materials are these: Birth of Pakistan, with a historical perspective, plus political, social, and administrative factors; law and constitutional development, including civil and administrative law, and the judiciary; governmental organization and reorganization; administrative structure, the center, provinces and regions; bureaucracy, both civil and military; administrative management of personnel, finances, and organizations, with methods; local government and community development, with regard to social institutions; politics and political development, considering general characteristics, ethnic groups and regional areas, elections, parties, interest groups, and martial law; planning and economic development, including foreign aid and technical assistance; social welfare and program development, involving education, agriculture, natural resources, labor, health, cooperatives, communications, transportation, family planning, and population; public corporations and semi-



autonomous bodies; and foreign relations. An author-institutional index is included. Most of the citations refer to items published during the years 1968-70.

### **Solving Health Care Problems With the Simulation Approach**

Michigan State University, Department of Agricultural Economics. Glenn L. Johnson. 1971. 30 pages.

**PB-229 052/GIX PC \$3.75/MF \$2.25**

Simulation research is a promising approach for studying the problems of the health care industries, at either the project, the program, or the policy levels. Simulation appears to permit both private and public decision makers to assess the consequences of alternative courses to solve problems, and to aid in designing and selecting solutions. The paper explains the functions of simulation, and traces briefly a few of the experiences that agricultural economists have had using this approach. Next a consideration is made of selecting the systems for modeling, along with the steps involved in building and using simulation models. The discussion is then applied to health care of the aged commercial farmers in a particular area of Michigan. After this, some criticisms and shortcomings of the simulation approach are presented, followed by a brief summary of the place of simulation in solving health care problems.

### **Improving Performance in Technical and Apprentice Training**

Development Systems Corp. Arthur E. Oriol. March 1974. 235 pages.

**PB-231 241/GIX PC \$7.50/MF \$2.25**

Historical records indicate that the apprenticeship system has, for more than 4000 years, been the single most important, most prevalent, and perhaps the most effective method of training skilled craftsmen. Despite the inherent strengths and past achievements of the apprenticeship movement, this tradition oriented approach has served to some extent to feed upon itself and to impair the responsiveness of most apprentice training programs to: rapid variations in the numbers of skilled workers needed by industry, the advantages of modern educational technology, and the increasing need of industry—as demonstrated in every recent study—for both specialists and all-around craftsmen. This report describes a study which was undertaken to demonstrate that, through the judicious application of modern training technology, an effective first year apprentice training program could be developed in which performance is the primary criterion of success and training time is allowed to vary with individual capability. The program, called Performance Based Apprentice Training (PBAT), was tested on individuals entering first year apprenticeship in the metal trades crafts (machinists, tool and die makers, machine repairmen). Among the results were: The experimental (PBAT) group of first year metal trades apprentices completed a full year of related instruction in an average of 61 hours compared to the 144 hours usually recommended for the first year of apprenticeship; in relation to a comparison group that had received an average of 187 hours of conventional related training, the PBAT group (with 61 hours) scored 30% higher on a related instruction final examination; after less than 40 hours of training the ratings of the quality of shop performance on four basic machine tools of the PBAT group exceeded those of the comparison group after nearly 1,200 hours of shop training; the time required for first year apprentices to learn to perform to an acceptable criterion in both related and shop training varies widely from one individual to the next and, if time is allowed to vary, the average apprentice will complete training in considerably less time than the standard hours now recommended.

## **Technology Transfer**

### **Interactions of Science and Technology in the Innovative Process: Some Case Studies**

Battelle Columbus Laboratories. C. M. Schwartz, G. W. Levy, et al. March 1973. 218 pages.

**PB-228 508/GIX PC \$7.25/MF \$2.25**

Innovation is both the sum and the result of the complex operations through which the inventive, scientific, and entrepreneurial genius of society produces social and economic impact on that society. This report is concerned with developing an understanding of the process and mechanism of technological innovation. It brings together a series of case studies of the significant events in several technological innovations of high social impact. These cases illustrate the diverse ways by which research and development activities support each other in the innovative process. Consideration is also given to the role of certain socioeconomic and managerial factors in promoting each of the innovations. The case studies deal with the following specific innovations: Heart pacemaker; hybrid grains and the green revolution; electro-photography; input-output economic analysis; organophosphorus insecticides; oral contraceptives; magnetic ferrites; and the video tape recorder. The document should prove useful to those interested in the stimulation of technological innovation. (An abridged version of this document is available as PB-228 509.)

### **Science, Technology, and Innovation**

Battelle Columbus Laboratories. Samuel Globe, G. W. Levy, and Charles M. Schwartz. February 1973. 38 pages.

**PB-228 509/GIX PC \$3.75/MF \$2.25**

Innovation is a term that describes certain activities by which society improves its productivity, standard of living, and economic status. Basic to the progress of innovation are the tools, discoveries, and techniques of science and technology. In an attempt to understand better how innovation proceeds, and how it is supported by science and technology, an examination was made of several innovations of high social impact. The document summarizes the results of this examination. The specific innovations involved are: The heart pacemaker; hybrid grains and the green revolution (hybrid maize, hybrid small grains, green revolution wheats); electro-photography; input-output economic analysis; organic-phosphorus insecticides; oral contraceptives; magnetic ferrites; and video tape recorders. (This document is an abridged and less technical version of PB-228 508.)

### **Barriers to Innovation in Industry: Opportunities for Public Policy Changes**

Arthur D. Little, Inc.; and Industrial Research Institute, Inc. Michael Michaelis, and William D. Carey. September 1973. 165 pages.

**PB-229 898/GIX PC \$6.25/MF \$2.25**

Technological innovation, the process by which an idea or an invention is put into the economy, is a complex process which can be viewed as a benefit by some interests and as a threat to existence by others. The document is concerned with barriers to innovation, particularly those which create a long lead time between the discovery of a new technology and its adoption. It is expected that the results could lead to prerequisites for developing public policies and stimulating the innovative process. The concern is not with increasing the amount of innovation but on removing delays and blockages. It would appear that marketing is of primary importance to the problem, along with lack of capital for initiating new ventures, and governmental policies and practices with regard to patents, antitrust considerations, and regulations. The findings are regarded as indicative of possibilities.



## Transportation

### On the Stability of the Railroad Track in the Vertical Plane

New York University. Arnold D. Kerr. November 1972. 39 pages.

**PB-222 362/GIX**

**PC \$3.75/MF \$2.25**

Railroad track rails are subject to changes in length with changes in ambient temperature. Conventional track consists of a sequence of rails joined by slotted web plates and bolts at the rail ends, forming expandable joints. Such joints weaken the track, increase the power consumption of a running train, and generate discomforting noise. Since the early days of railroading, reduction in the number of joints has been sought, leading toward their eventual elimination and incorporation of welded rails. The welded rail is still subject to expansion, which during periods of hot weather can cause buckling, and in turn produce the possibility of derailment. For high speed trains the welded rail appears to be a necessity, so that a reexamination of the state-of-the-art of track instabilities is called for. The present paper reviews the literature on track buckling in the vertical plane. First, buckling tests of straight tracks are discussed, considering the track to be either an elastic beam continuously supported by a Winkler base, or a beam of uniform weight reaching a buckling load when part of the track lifts itself off a rigid base. Two simple models are presented to clarify some of the assumptions.

### Airport Travel Survey Manual

Barton-Aschman Associates, Inc. July 1973. 105 Pages.

**PB-226 121/GIX**

**PC \$5.25/MF \$2.25**

An airport may be viewed as the interface between land and air transport; as such, it becomes important to quantify the use of and demand for facilities for access to and egress from air terminals. The facilities may include highways, rapid transit systems, bus lines, limousines, rental vehicles, and taxicabs. Access and egress will require a variety of services and facilities involved in this land-air modal interface. The purpose of the report is to present guidelines for the collection of data on ground travel patterns, trip maker characteristics, and movements about airports. It is directed toward those responsible for conducting airport travel surveys, such as transportation, city, and airport planners, the traffic engineers and managers, and the technicians. Data collection techniques refer to facilities within the public domain as opposed to those operated by the airlines. An overview is made of eight major steps in the travel data collection process. Advantages and disadvantages of alternative survey strategies are discussed along with the various types of data collection techniques used. Guidelines are also included for processing the survey data and monitoring the airport travel patterns following completion of the basic investigations. Some attention is given to bias reduction and sample selection.

### The Vov Standard Bus

National Transportation Center. July 1973. 122 pages.

**PB-227 478/GIX**

**PC \$5.25/MF \$2.25**

A presentation is given on an urban transportation bus developed in the Federal Republic of Germany within an association of public transport operators (Verband Öffentlicher Verkehrsbetriebe). The vehicle has been intended to incorporate as many standard features as possible. Three elements enter into the standardization: requirements imposed on manufacturers, components desired by the manufacturers, and guidelines for buyers as well as manufacturers. A theoretical concept was drawn, followed by model development, leading to the production of a full scale dummy prototype. The basic design is a single deck biaxial bus, from which other types such as articu-

lated, one and a half, or double deck can be derived. The essential requirements are economic factors, speed range, passenger comfort, and safety. Fast passenger flow is necessary, calling for optimization of floor dimensions and shape. Wheel diameter involves the relationship to seats, whereas tire size is based on the permissible gross weight of passengers plus vehicle. The report discusses a number of important features including bus floor-to-sidewalk level difference, air suspension system as related to street level, vehicle length, passenger access, side window and door size, front overhang, windshield mechanisms for wiping and defrosting, rear overhang, and the vehicle transmission system. Attention is devoted to instrumentation, electrical equipment, braking and pneumatic systems, and maintenance.

### Transportation Systems Planning and Resource Allocation

National Research Council, Highway Research Board. Richard J. Angello, Willard F. Babcock, et al. 1973. 87 pages.

**PB-228 607/GIX**

**PC \$4.75/MF \$2.25**

Ten reports prepared for an annual symposium deal with various facets of the highway transportation planning process. Among the topics covered are environmental aspects, pedestrian travel, public relations, ecological considerations, traffic generation, allocation of resources, project costs vs. revenues, time losses from highway bottlenecks, accident costs, and investment alternatives. Other aspects of interest are land use, tradeoffs in organizing systems, environmental mapping, computer applications, bridge traffic, and economic forecasting. In addition, discussions are given of site selection, decision making, and design standards. Indications are made for remedying the present lack of satisfactory transportation models.

### Literature Survey of Tire-Road Experiments

University of Michigan, Highway Safety Research Institute. James F. Sinnamon. February 1974. 140 pages.

**PB-229 893/GIX**

**PC \$5.75/MF \$2.25**

Tire properties of primary importance in determining vehicle performance are: 1) those mechanical properties which affect the handling response of the tire-vehicle system; and 2) the maximum friction capability of the tire, especially on wet surfaces, usually called skid resistance. This document provides a review of the literature on the subject. Coverage is limited to literature sources which report the results of tests performed with real tires on actual road surfaces. Consideration is given to techniques of measuring tire traction performance and to the effects of the following factors: Tread pattern, tread compound, tire construction, tire load and inflation pressure, water depth and tire speed, road surface texture, hydroplaning, and combined braking and cornering. Detailed summaries are given of 38 test reports.

### Manual of Procedures for Conducting Studies of the Desirable Limits of Dimensions and Weights of Motor Vehicles

Federal Highway Administration, Environmental Design and Control Division. Robley Winfrey. July 1970. 147 pages.

**PB-231 387/GIX**

**PC \$5.75/MF \$2.25**

From the point of view of society as a whole and highway transportation in particular, the desirability of specific limits on the dimensions and weights of motor vehicles is not a finding that, having once been made, can stand forever. The problem

one of continuing importance, and must be the subject of continuing inquiry. This manual has been prepared as a specific aid in conducting studies on the desirable limits on the dimensions and weights of highway vehicles. It is written as though it would be used by an independent investigator, not one whose results would be merged with those of others to form a national or regional study. Obviously then, the investigator must be free to adopt those procedures that will permit the best use of the available resources and that offer the best chance of gaining his objectives. For this reason, an effort is made to avoid suggesting that there is only one specific procedure that will produce the desired results. Consideration is given to: Vehicle dimensions and the factors involved; analysis of economy of transportation (increased vehicle weight and dimension vs. increased highway construction and maintenance costs); determining the economy of increased dimension and axle-weight limits, based on hauling a given number of daily payload weight units over one unit distance of new highway; determining the economy of vehicle length; presenting the results of economy studies; highway financing under increased axle-weight limits.

### **Economics of the Maximum Limits of Motor Vehicle Dimensions and Weights. Vol. 1**

Federal Highway Administration, Environmental Design and Control Division. Robley Winfrey. September 1968 (Released May 1974). 279 pages.

**B-231 519/GIX PC \$8.75/MF \$2.25**

The geometrics of highway design have changed over the years to accommodate both larger volumes of vehicles and faster moving vehicles and to increase the safety of travel. As the standards of design have been raised from year to year, vehicles in the commercial group have been getting larger and heavier. This report presents the results of research designed to discover and evaluate the factors of transportation economy involved in the legal maximum limits upon the dimensions and weights of motor vehicles. It attempts to provide the factual basis for improved judgment as to the requirements for legislative and regulatory policy with respect to these limits and also for engineering design. The factors considered were those determining the economy of transportation and capable of being quantified and priced. They include highway construction and maintenance costs, motor vehicle operating cost, and certain economic and service aspects of the highway transport industry, such as cargo handling and fleet operations. Topics covered in Volume 1 include: Desirable maximum limits on motor vehicle dimensions; effects of gross vehicle weight on motor vehicle performance in traffic (vehicle gross weight and horsepower, braking performance of commercial vehicles); highway safety (frequency and cost of accidents, probable relationship of increased vehicle dimensions and weights to accident experience); highway costs (relationship of highway construction costs to changes in vehicle dimensions and weights, unit prices of highway cost elements, construction cost of structures, cost of maintaining the highway); line-haul trucking costs in relation to vehicle gross weights.

### **Economics of the Maximum Limits of Motor Vehicle Dimensions and Weights. Vol. 2**

Federal Highway Administration, Environmental Design and Control Division. Robley Winfrey. September 1968 (Released May 1974). 397 pages.

**B-231 520/GIX PC \$10.25/MF \$2.25**

This second volume of a two-volume report includes the following topics: Methods for determining the economy of maximum axle-weight limits; determination of the economy of vehicle length; economy of simultaneous increases in the limits of axle weight and of vehicle length; transportation factors

in hauling 2000 tons of payload one mile and the marginal limits of vehicle weights; highway financing requirements under increased axle-weight limits.

## **Urban and Regional Technology**

### **Regional Modeling Abstracts: A Bibliography of Regional Analysis. Volume 4**

Oak Ridge National Laboratory, Environmental Program. Charles R. Meyers, Jr. March 1973. 391 pages.

**ORNL-NSF-EP-37/GIX PC \$21.75/MF \$2.25**

This bibliography contains approximately 1000 abstracts from the literature concerning the development and use of mathematical models capable of simulating the economic, demographic, societal, ecological, and land-use responses of a geographical region to alternative policy decisions. Author and title indexes are included. (For the previous volumes in this series, see AMTID, July 1973, page 56.)

### **An Urban Classification Scheme: The Development of a Simple Urban Model**

Oak Ridge National Laboratory, Urban Research Section. Margaret M. Williams. April 1973. 24 pages.

**ORNL-UR-108/GIX PC \$3.25/MF \$2.25**

Small areas within a city can be compared along many social dimensions. Such dimensions may pertain to an area's economic and educational level, family and age structure, housing quality, crime rate and so on—the list can be very extensive. There is, therefore, a very practical need to arrive at a few simple dimensions that somehow embrace many of the ways areas within a city differ. This document shows how the identification of a few useful dimensions may account for a large proportion of the social variability between small areas within a city. Also, a quantitative approach is formulated whereby an area's ranking on these dimensions will suggest presence, or lack of, particular social problems. The development of these quantifiable dimensions should prove useful to urban policy makers.

### **Forecasting Local Government Spending**

The Urban Institute. Claudia DeVita Scott. 1972. 157 pages.

**PB-234 245/GIX PC \$6.25/MF \$2.25**

Budgeting is of first importance in municipal administration, since all critical policies and decisions are determined during the budgetary process, and the groundwork is laid for goal achievement and fiscal control. Modern high levels of expenditures, with a probability of continued rise, and the shifting priorities for public services demand a good forecasting ability. This book combines a model approach and a module concept to forecast expenditures for basic municipal governmental services, such as education, fire, police, health, welfare, etc. It provides a basis for further refinements, new models, and other approaches. The discussions of an expenditure model deal with projection practices; model tests; background analysis; patterns of expenditure by type of service; a linkage between expenditure and revenue models; and model formulae involving factors such as employee unions, public works, capital improvements, executive development, fringe benefits, and personnel requirements. Practical aspects are emphasized.



### **Management Performance in Public Housing**

The Urban Institute. Robert Sadacca, Suzanne B. Loux, et al. January 1974. 140 pages.

**PB-234 248/GIX**

**PC \$5.75/MF \$2.25**

Considerable attention is being devoted to improving management principles and practices in public housing projects in order that successful operation may increase and the incidence of failure may be decreased. To identify effective principles and practices, an extensive interview survey was made of management personnel and tenants with regard to satisfaction levels, management methods, building characteristics, and neighborhood conditions. Financial data were obtained from governmental records. There were 24 criterion measures for both high and low performance classifications, involving management perceptions of building maintenance, rules, and needs, and tenants' opinions of these factors. It would appear that poorly functioning authorities should consider changes in management style in order to raise performance levels and lower costs. The questionnaire used was directed also to innovative methods and new approaches.

### **The Struggle to Bring Technology to Cities**

The Urban Institute. 1971. 84 pages.

**PB-234 376/GIX**

**PC \$4.75/MF \$2.25**

Area development is usually hampered to some degree by resistance to change. In the case of urban development, the obstacles appear to be reluctance to depart from tradition, budgetary constraints against the adoption of technological innovations, and a basic lack of scientific understanding coupled with an ingrained distrust of unfamiliar leaders. As a result, local governments fail to use what is currently available on the market, although it seems to be more and more apparent that the old tried-and-true products can be replaced if technology and the city can get together on precise problems and effective delivery systems. The report stems from the ideas and issues discussed at a 1970 symposium held in Washington, D. C. Among these are problems of management with outmoded technology, the handling of trash and garbage, firefighting advances, computerized traffic control, and the study of complaints about the cities, the industrial sector, and the experts.

### **Public Prices for Public Products**

The Urban Institute. Selma Mushkin (Ed.). 1972. 459 pages.

**PB-234 377/GIX**

**PC \$11.50/MF \$2.25**

A detailed examination is made of market-type pricing practices as an efficient means of financing public commodities and services. Eighteen essays, covering a broad variety of approaches, examine the feasibility of levying certain fees and charges for a variety of public products and services involving hospitals, solid wastes, water, public education, recreation, and public transportation. The interrelations between demand, incentives, support, management, and patronage are considered, and the function of prices is discussed for determining whether to rely on the public or the private sectors. A review is made from the perspective of economic theory and political practicality. A challenge is directed toward economists and political scientists in dealing with gaps in knowledge and techniques.

## **Waste Processing & Materials Recovery**

### **Preventing Landfill Leachate Contamination of Water**

Gulf South Research Institute. E. J. Wren. 1973. 119 pages.

**PB-222 468/GIX**

**PC \$5.25/MF \$2.25**

Refuse used as landfill contains mineral and organic substances in quantities capable of seriously damaging underground water supplies. Organic matter will produce large volumes of carbon dioxide that may seriously degrade ground water by dissolving calcium, magnesium, and iron. Leaching and ground water travel contribute chloride, total hardness, total solids, total organic nitrogen, and nitrate and biological contamination as well, in some instances. Thus, it should be of practical value to provide methods for shielding or preventing leachate penetration into the subsurface ground by any means available. This report gives the results of a study undertaken to identify and test materials that might prove useful in sanitary landfill engineering to prevent or limit permeation of contaminating leachates through the landfill soil into adjacent streams or ground water tables. The effectiveness of available commercial materials and industrial waste products as sealants is discussed.

### **Economic and Technological Impediments to Recycling Ferrous Solid Waste**

National Environmental Research Center, Solid and Hazardous Waste Research Laboratory. Oscar W. Albrecht and Richard G. McDermott. October 1973. 62 pages.

**PB-223 034/GIX**

**PC \$4.25/MF \$2.25**

Although ferrous waste comprises only a small fraction of the usual solid waste total, the problems it presents to waste management are its slow rate of degradation in landfills and its accumulation on landscapes. It is also the residual of a nonrenewable resource. A portion of ferrous solid waste is readily recycled. This is the waste generated by the steelmaking process and by fabricating operations. It is the obsolete ferrous waste, especially the worn-out and discarded types from consumer use, that presents an increasing problem in solid waste management. This report focuses on problems associated with recycling this latter type of ferrous waste. Consideration is given to the nature of the solid waste problem, current utilization of ferrous solid waste, impediments to increased use of ferrous scrap, implications for public policy, environmental implications, and the need for further research.

### **Optimal Procedures for the Processing of Waste Activated Sludge**

Virginia Water Resources Research Center; University of Arkansas. Department of Civil Engineering; and Puerto Rico Department of Public Works, Environmental Engineering Bureau. Clifford W. Randal, David G. Parker, and Antonio Rivera-Cordero. August 1973. 93 pages.

**PB-223 128/GIX**

**PC \$4.75/MF \$2.25**

All conventional waste treatment processes produce large quantities of waste material in the form of dilute solids mixtures known as sludge. Generally, raw sludge must undergo further processing after separation to reduce the volume and stabilize the organic material before disposal. Two of the major operations in the sequence of solids disposal are the processes of sludge digestion, or stabilization, and sludge dewatering. The cost of sludge handling and disposal frequently exceeds the capital and the operating costs of any other reduction of sludge handling and disposal costs is needed to maintain the economic viability of pollution abatement programs. The intent of this document is to provide a guide, based on experimental evidence, that can be used by a wastewater plant designer or operator to improve the efficiency of sludge processing and thereby reduce the costs. The primary objectives are to define sludge handling procedures that are destructive to activated sludge dewaterability, to explore techniques that can improve filterability, and to determine the mechanisms that control changes in sludge dewatering characteristics.



## **Lagoon Performance and the State of Lagoon Technology**

Lyckman, Edgerley, Tomlinson and Associates, Inc. George Marsom. June 1973. 221 pages.

**PB-223 129/GIX**

**MF \$2.25**

Oxidation lagoons have gained widespread use in the past 25 years as a waste treatment process. This is partially due to their relatively low cost and ease of maintenance. The purpose of this intermediate water body is to provide treatment of sewage without degrading the quality of the receiving streams. The report considers a quantity of statistical data on influents and effluents, with particular regard to effluent characteristics. The widespread acceptance of lagooning is based on the initial observance of the lagoon to produce effluent quality at least equivalent to accepted secondary treatment. Factors limiting lagoon performance are discussed, including organic and hydraulic overload, odor and esthetic failures, wind, mixing, and sludge processing. Recommendations for upgrading lagoon performance are made. Operative and inventory data from several municipal facilities are evaluated. (Paper copy available only from: U. S. Government Printing Office, Washington, D. C. 20402, U.S.A.; price \$2.25. Microfiche copy is available from NTIS.)

## **Biological Treatment Technology**

Environmental Protection Agency, Water Program Operations. F. J. Ludzack (Ed.). December 1973. 326 pages.

**PB-228 148/GIX**

**PC \$9.50/MF \$2.25**

This training and reference manual is intended for use by graduate engineers and scientists now engaged in or about to be involved in planning, design of facilities, upgrading operation of existing facilities, and other responsibilities associated with biological renovation of wastewater. It includes comprehensive consideration of the strong points and limitations of aerobic and anaerobic water renovation processes, the variations most likely to affect performance, and the means to control process performance. Specific topics covered include: Nutrients as the basis of productivity; bioassay and biomonitoring; toxicity in treatment plant practices; basis of chlorination of wastewaters; schematics, functions, and options in wastewater treatment; behavior of specific chemical compounds in the aquatic environment; sampling in wastewater treatment operations; dissolved oxygen determination; biochemical oxygen demand test procedures; chemical oxygen demand; total carbon analysis; ammonia, nitrites; sources and analysis of organic nitrogen; determination of phosphorus; solids relations in polluted water; determination of suspended solids; procuring and applying laboratory biooxidation data; bench scale determination of waste treatability; versatile activated sludge pilot plant; bench data activated sludge; status of the activated sludge process; fundamentals of trickling filtration waste treatment; design of trickling filtration systems; status of oxidation pond processes; small treatment systems; advanced waste treatment plants for small waste flows; anaerobic process principles; liquid to solid transfer; sludge disposal by land spreading; sludge combustion.

## **Proceedings of the 1972 Cornell Agricultural Waste Management Conference**

Environmental Protection Agency; and Cornell University, College of Agricultural and Life Sciences. 1972. 591 pages.

**PB-230 861/GIX**

**PC \$13.00/MF \$2.25**

The purpose of the conference was to present the latest efforts in agricultural waste management research. The presentations, which are included in this document, were made by producers

of agricultural products, consulting engineers, researchers, and equipment manufacturers, associated with environmental governmental agencies. Such topics are included as the economic impact of pollution control programs, public relations and waste management, the permit program for poultry and animal feeding, water pollution control law applied to livestock operations, public and private livestock waste regulations, state legislation, citizen initiated legal actions, pyrolysis for cattle foodlot waste disposal, dairy manure handling, and aeration rates for composting. Other considerations are swine wastes, wastes from caged laying hens, hen manure drying pellet storage of manure solids, chemical studies of runoff and groundwater, economy in management of food processing waste, hydraulic manure transport, residues from the animal glue industry, management alternatives, and allied subjects.

## **Reclamation of Energy From Organic Waste**

University of Illinois, Department of Civil Engineering. John T. Pfeffer. 1974. 142 pages.

**PB-231 176/GIX**

**PC \$5.75/MF \$2.25**

Among the many challenges confronting the world as a whole are two seemingly unrelated problems. The first and perhaps the more obvious of the two is a problem of solid waste management. The second is the decline in energy resources as evidenced by the increasing shortage in natural gas reserves. The development of a process to convert organic refuse into methane would provide at least a partial solution to both of these problems. This document concerns an evaluation of the potential for reclaiming methane gas from organic refuse by means of anaerobic fermentation. The primary purpose is to define the problems likely to be encountered in the fermentation of organic refuse, and to develop information to evaluate the feasibility of using this process on a large scale. Studies were undertaken to determine the response of the methane fermentation process to external variables such as temperature, retention time, pH, and feed slurry concentration. Potential operational problems were identified. The environmental and nutritional requirements for the fermentation of urban refuse were evaluated. The quality and quantity of gas production were determined for various operating conditions. From the data collected it was possible to evaluate the practicality of employing this process as a means of reducing the quantity of refuse for disposal while reclaiming a useful product, methane.

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## **ABOUT NTIS**

The Commerce Department's National Technical Information Service, one of the world's largest processors of useful technical information, is the central point in the United States for public sale of research, development and other government-funded reports prepared by federal agencies, their contractors, or grantees.

Each year some 60,000 new titles are added to the NTIS collection; the computer file at NTIS now contains well over 400,000 titles. More than four million paper and microfiche copies are distributed annually by NTIS to over 200,000 customers.

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Reprinted from Commerce Today, March 17, 1975.

# Workshop Facilitates Technology Transfer To Developing Countries

The first foreign graduates of the Information Systems Workshops conducted by Commerce's National Technical Information Service are returning to their respective countries to begin applying what they have learned. Representatives of agencies cooperating with NTIS in Colombia, Ecuador, Korea and the Philippines completed the workshop in Washington, D.C., recently.

Since all the agencies have already begun marketing efforts, their representatives were able to report on the different approaches being taken.

Ms. Manolita Leuterio, of the Development Academy of the Philippines, recounted how the Academy is reaching potential customers for NTIS materials: mailings were sent to government agencies and industrial institutions, and ads were placed in local newspapers announcing the availability of the service. The Academy also participated in a catalog show on the environment at the U.S. Embassy in Manila. All NTIS materials sent out have the Academy name stamped on them, to facilitate reordering.

Chung-Jac Cha of KORSTIC—Korea Scientific and Technical Information Center, located in Seoul, told how his agency had placed newspaper ads in both Korean and English to reach its potential audience, and had also advertised in bulletins of Chambers of Commerce, federations and other business groups. KORSTIC also participated in a catalog show on the environment. The Center mailed some 3,000 leaflets to selected recipients, including its regular customers and many at the Agency for Defense Development, a major user of NTIS material. One-third of KORSTIC's customers receiving the mailing requested further information. Future plans include participating with NTIS in a joint exhibit at the 1976 International Federation of Library Associations conference to be held in Seoul.

## Urgently needed skills

John J. Carchi of CENDES—Centro de Desarrollo Industrial, Guayaquil, Ecuador, said that his agency is promoting business administration and management documents heavily, as these skills are more urgently needed in Ecuador

than purely technical ones. CENDES publishes a monthly bulletin and includes advertisements for NTIS services in it. The agency plans a follow-up of all its customers, especially those purchasing NTIS documents, to find out what use they are making of the information.

Ms. Balbina Chavarro de Montanes, of COLCIENCIAS—Fondo Colombiano de Investigaciones Cientificas y Proyectos, of Bogota, Colombia, said that COLCIENCIAS has sent letters and sample publications to universities and other institutions announcing NTIS services, and she has begun personally contacting libraries. In the planning stages are setting up a reference section and instituting a deposit account system like that used by NTIS. COLCIENCIAS also plans to expand NTIS promotion to its cooperating offices in other cities in the near future.

During the three-week training program the representatives were thoroughly briefed on all phases of NTIS operations, from the processing of incoming documents to marketing methods. They learned of NTIS plans for their countries and were given the opportunity to discuss any problems they had encountered.

They visited other information sources, such as the Library of Congress, the National Library of Medicine, the Educational Resources Information Center and the Smithsonian Science Information Exchange, to study their operations.

In developing countries, technical institutes, industrial associations, universities and similar organizations often perform information dissemination services for specialized groups of users early in the development process. However, a national technical center eventually becomes a necessity to the overall technical information needs of a country. Such a center may end up coordinating all information activities within a country into an efficient national program.

An example of the way in which technical information can aid in a country's development was given by an official of Ecuador's CENDES. He identifies the slow development of small Ecuadorian industry as due principally to the lack of a general policy of coordination and development. He cited, specifically, lack

of an appropriate economy, deficient management practices, lack of market edge, low productivity and deficient technologies, all of which he felt could be improved through transfer of technology.

He sees his company becoming a catalyst in the development of small industry in the country. The transfer of technical assistance information to state institutions makes coordination possible.

About two years ago, NTIS and the U.S. Agency for International Development began an experimental program designed to make it easier for developing countries to more fully utilize this information. All of NTIS' information is available at cost to countries that can use newly developed technical information to speed up their industrial progress.

## Provides for training

It was under this program that engaged organizations to distribute publications in developing countries. The agreement provides that representatives of these agents come to Washington for training.

The three objectives of the U.S. NTIS cooperative effort are:

- to facilitate utilization of U.S. technical and scientific information in developing countries,
- to establish links between NTIS and the scientific and technical information services in developing countries,
- to strengthen, through these links, the capabilities of those information services.

Most technical reports that result from U.S. government-sponsored research are available for purchase from NTIS. The collection of documents now totals some 800,000. NTIS is the primary source for scientific and technological information developed by federal agencies, contractors and grantees. Almost from birth, the United States has been willing to share with other nations the scientific and technological information it has developed. One reason for this, of course, is that as the developing countries improve their technology, they may be able to produce U.S.-built equipment to meet their





Pictured left to right are: Manolita Leuterio, Phillipines; Balbino de Montoñes, Columbia; Tae Seung Kim, Korea; John J. Corchi, Ecuador; Eleanor J. Aronson, NTIS; and Chung Jae Cha, Korea.

# 1974 Government Reports Annual Index



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## Water Supplies & Hydrology

### ERTS-1 Applications in Hydrology and Water Resources

Goddard Space Flight Center (NASA). V. V. Salomonson, and A. Rango. May 1973. 25 pages.

**N73-23468/GIX**

**PC \$3.25/MF \$2.25**

To become more efficient in the use of available water supplies and to find new sources of water, a system of observation and monitoring is required that can cover large areas on a repetitive basis and identify water sources or indicators relevant thereto. Such a system became available when the Earth Resources Technology Satellite (ERTS-1) was placed into earth orbit in July 1972. This paper describes in some detail the content and character of ERTS-1 observations as they relate to hydrology and water resources. It also summarizes some of the applications that have been made with these data. Subjects covered include: Watershed Physiography and Land Use; Snow Cover; Glaciology; Surface Water; Flooding; Satellite Data Relay.

### Remote Sensing of Water Quality: A State-of-the Art Report

Florida University. Department of Environmental Engineering Sciences. W. J. Mitsch. May 1973. 16 pages.

**PB-223 503/GIX**

**PC \$3.25/MF \$2.25**

Remote sensing, or the investigation of surface phenomena of the earth from space or from an airborne vehicle may in some cases be more time and cost efficient than measurement at a site itself. The technology combines the effects of modern detectors, data processing equipment, information theory, processing methodology, and communication systems. The report discusses some basic components of remote sensing systems. These include an energy source—either active, as radar or passive as reflected sunlight; a propagating system, thru the air or thru water, which involves the transmission and blocking of electromagnetic energy; an energy sensor, including cameras, thermal infrared scanners, multispectral detectors, radar equipment, microwave systems, laser instruments, and radio; and a platform, either in aircraft at various elevations, spacecraft or satellites in earth orbits, or ground installations on the earth's surface. The most valuable techniques for water supply studies at present appear to be photography, infrared scanning, and multispectral scanning. For example, aircraft applications include the measurement of various waste discharges into water bodies, the study of aquatic plant growth, and observations of benthic communities. Satellite scanning offers possibilities for periodic measurements.

### Predicting Groundwater Basin Response to Pumping and Recharge Operations Using Surrogate Parameters

Colorado State University, Department of Civil Engineering. John Labadie. 1972. 27 pages.

**PB-228 242/GIX**

**PC \$3.75**

Considerable effort is going into applying modern water management practices in the developing countries to increase food production and to lessen the need for food importation. The

groundwater resource is a prime focal point, particularly in nations with large arid or semiarid regions. The report discusses two model formulations for analyzing groundwater basins. A simulation approach is first described, leading to some ordinary differential equations. Some weakness in this method is noted. A surrogate parameter approach is then discussed regarding basic assumptions, input-output characteristics, and advantages. Here the complexities of the near-well basin are lumped into a set of parameters that appear valid for the porous media immediately surrounding the well. It is assumed that for a nonhomogeneous nonisotropic aquifer having no interference from adjacent wells or from boundary effects, prediction would be accurate using one basic flow equation but lumping several highly variable parameters into a single pair. A computational example is given using a four well system tapping a confined aquifer. The method appears applicable to a locality such as Pakistan. Complexities include such factors as pumping or artificial recharge, leaky systems, highly stratified formations, and rising water.

### Water Quality and Treatment of Domestic Groundwater Supplies

Illinois State Water Survey. James P. Gibb. 1973. 19 pages.

**PB-228 672/GIX**

**PC \$3.25/MF \$2.25**

There is considerable and constant demand for information and advice on locating, developing, and treating home and farm water supplies. The report presents basic data on water quality and handling of domestic and agricultural groundwater supplies. It describes tests and practices that assure safe, sanitary water quality, and discusses in detail the common minerals and natural gases of concern to home water supplies. It also describes water treatment procedures and equipment for disinfection, iron removal, softening, methane and hydrogen sulfide removal, and the costs involved.

### Planning a Domestic Groundwater Supply System

Illinois State Water Survey. James P. Gibb. 1973. 16 pages.

**PB-228 686/GIX**

**PC \$3.25/MF \$2.25**

Individuals wishing to develop a private or home groundwater supply may not be able to afford the advice of a consulting engineer. The report is offered as a source of basic information needed for planning and use. A logical planning sequence is outlined. Accepted and recommended methods for checking requirements and analyzing the available supply are presented. Included are brief discussions on the occurrence, movement, availability, and quality of groundwater in a representative locality, along with a description of the common types of wells and pumps. In areas where water is scarce or difficult to obtain, careful planning becomes of first importance, and a clear-cut solution to obtaining the desired quality may not be obvious in a number of other instances. Therefore some basic groundwater characteristics are given. Typical daily water requirements for livestock and poultry are tabulated. Depth of the water table is related to satisfactory operations.

### **Practical Simulation Models of the Subsurface Hydrologic System With Example Applications**

Auburn University, Water Resources Research Institute. F. J. Molz. January 1974. 51 pages.

**PB-228 963/GIX**

**PC \$3.75/MF \$2.25**

The watershed planner and developer has some difficulty in applying mathematical models of the subsurface hydrologic network to a field problem. The advanced models are mathematically complex and hard to solve computationally, and they usually call for a physiological, hydraulic, and geometric knowledge of the surface and subsurface hydrologic systems which does not exist. Yet progress is being made in developing the knowledge, and practicing hydrologists are able to apply what has been developed to a promising degree. The report discusses a three dimensional, transient, saturated-unsaturated subsurface model, applicable to an unsaturated one and a groundwater system composed of both confined and unconfined aquifers. Boundary conditions for pumping plans are essentially arbitrary. To derive the basic form of the simulation model, continuity is applied to the control volume, assumed to be a vertical prism of unconfined aquifer with the water table at the top and the aquifer base at the bottom. Inflow and outflow rates are mathematically described along with storage change rate. A manipulation of the equations produces the general form of the groundwater simulation model. Other factors to be considered are a source or sink term for surface processes, constant pumping and recharge factors, and a procedure for maintaining water balance on the watershed. Statistical data accompany the text.

### **A Pipe Bend Flow Meter for Measuring the Flow of Water From a Well**

Utah State University. Richard E. Griffin. November 1971. 25 pages.

**PB-229 276/GIX**

**PC \$3.25**

Proper management of any water resource requires that the quantity of water delivered by the system be known. The challenge is to use methods of measurement that are sufficiently accurate yet low enough in cost to permit installation of the required measuring devices. The pipe-bend flow meter, described in this document, is both economical and accurate. Such a meter can be installed by placing a 90° elbow at the end of the discharge pipe of a pump. Piezometers are attached to both the inside and outside of the bend. These consist of small openings in the pipe walls to which transparent tubes are attached. The vertical difference between water levels in the two tubes is a measure of flow occurring in the pipe. A detailed description is given on how a pipe-bend flow meter may be constructed and calibrated.

### **A Bibliography and Literature Review of Groundwater Geology Studies in the Indus River Basin**

Colorado State University. Alfred J. Tamburi. April 1973. 40 pages.

**PB-229 457/GIX**

**PC \$3.75**

Groundwater is an important part of the water resource of Pakistan's Indus Basin, and its optimum use is necessary to improve farm yields on irrigated lands. Owing to dislocations caused by the Indus Water Treaty of 1960 and the ill effects of salinity, water logging, and underwatering of cultivated

lands, the groundwater resource must be developed rapidly during the next few decades. This review and bibliography has been assembled both as an introduction to the available material, and as a guide to landmark papers and research trends over the years. It should also serve to give water resource planners and engineers an appreciation of the need for an understanding of the geologic and geographic setting. The review portion is concerned primarily with the geography, geology, water development, and trends in studies of groundwater geology. The bibliography covers the important publications on the subject dating from 1857 thru 1971.

### **A Selected Annotated Bibliography on the Analysis of Water Resource Systems. Fourth Volume**

Water Resources Scientific Information Center. Daniel P. Loucks (Ed.). December 1973. 494 pages.

**PB-229 894/GIX**

**PC \$12.00/MF \$2.25**

This bibliography contains abstracts of more than 300 selected publications pertaining to the application of systems analysis techniques for defining and evaluating alternative solutions to water resource problems. Most of the items included were published in 1972. Subject and author indexes are included. The abstracted material emphasizes the application of optimization and simulation techniques for assisting in the planning and management of water resource systems.

### **Multiobjective Planning for Multiple Purpose Water Resource Systems: A Structure for Regional Water Resource Development**

Intasa, Inc. D. P. Lijesen, A. P. Delarue, et al. November 1973. 213 pages.

**PB-230 619/GIX**

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This report, which was motivated by the realization that water resource planning plays a prominent role in regional resource management, has as its purpose the extension and improvement of the current state of the art in water resource planning. Six key phases are identified for the integrated process of planning and evaluating multiple purpose, multiple objective water resource systems: need identification, formulation of alternative systems, assessments of impacts, evaluation, display, and implementation. Case studies are used to demonstrate three practical planning tools: comparative analysis of alternative land use plans used to delineate economic and social impacts of different land uses and analyze their implications for water resource planning; tradeoff analysis used to assess the importance of benefit tradeoffs between flood control and urban recreation; sensitivity analysis used to determine necessary changes in the design and operation of a system designed primarily for water supply in order to accommodate other purposes. Finally, a stepwise procedure for planners is given.

### **Evaporation Suppression: A Bibliography**

Water Resources Scientific Information Center. December 1973. 478 pages.

**PB-231 200/GIX**

**PC \$12.00/MF \$2.25**

This bibliography contains more than 300 abstracts from the literature concerned with the mechanisms and control of evaporation from standing and flowing water bodies and from soil through the agency of vegetation. Most of the items included were published during the period 1968-72. Subject and author indexes are included.



### **Application of DDDP in Water Resources Planning**

University of Illinois, Department of Civil Engineering. Ven Te Chow, and Gonzalo Cortes-Rivera. January 1974. 93 pages.  
**PB-231 231/GIX**

The remarkable progress in recent years in advanced methodologies for water resources planning and development has been made possible mainly through the use of systems analysis and operations research techniques in the solution of complex problems involved in the design and operation of modern water resources projects. One of the operations research techniques that are found to be applicable to the mathematical analysis of water resources systems is dynamic programming, the reason being its ability to simulate the nonlinear, sequential-decision characteristic generally exhibited by most problems involved in the planning and operation of water resources projects. However, conventional dynamic program-

ming algorithms are only capable of handling problems of very low dimensionality, i.e., a few state variables, thus severely limiting the usefulness of the dynamic programming technique in water resources systems analysis which often involves many variables. To overcome the difficulties arising from the high dimensionality of water resources systems, the methodology of discrete differential dynamic programming (DDDP) may be used in many problems. The DDDP methodology is an iterative technique which permits the solution of high-dimensional dynamic programming problems within the range of computer time and memory capacities of high-speed digital computers now available. This report presents a detailed discussion of the DDDP methodology in a form suitable for its application to actual water resources problems by practicing engineers and analysts. An attempt is made to bridge the gap between the theory and the practice in the use of the DDDP methodology. It is intended to serve an introduction and as a working manual for practitioners.

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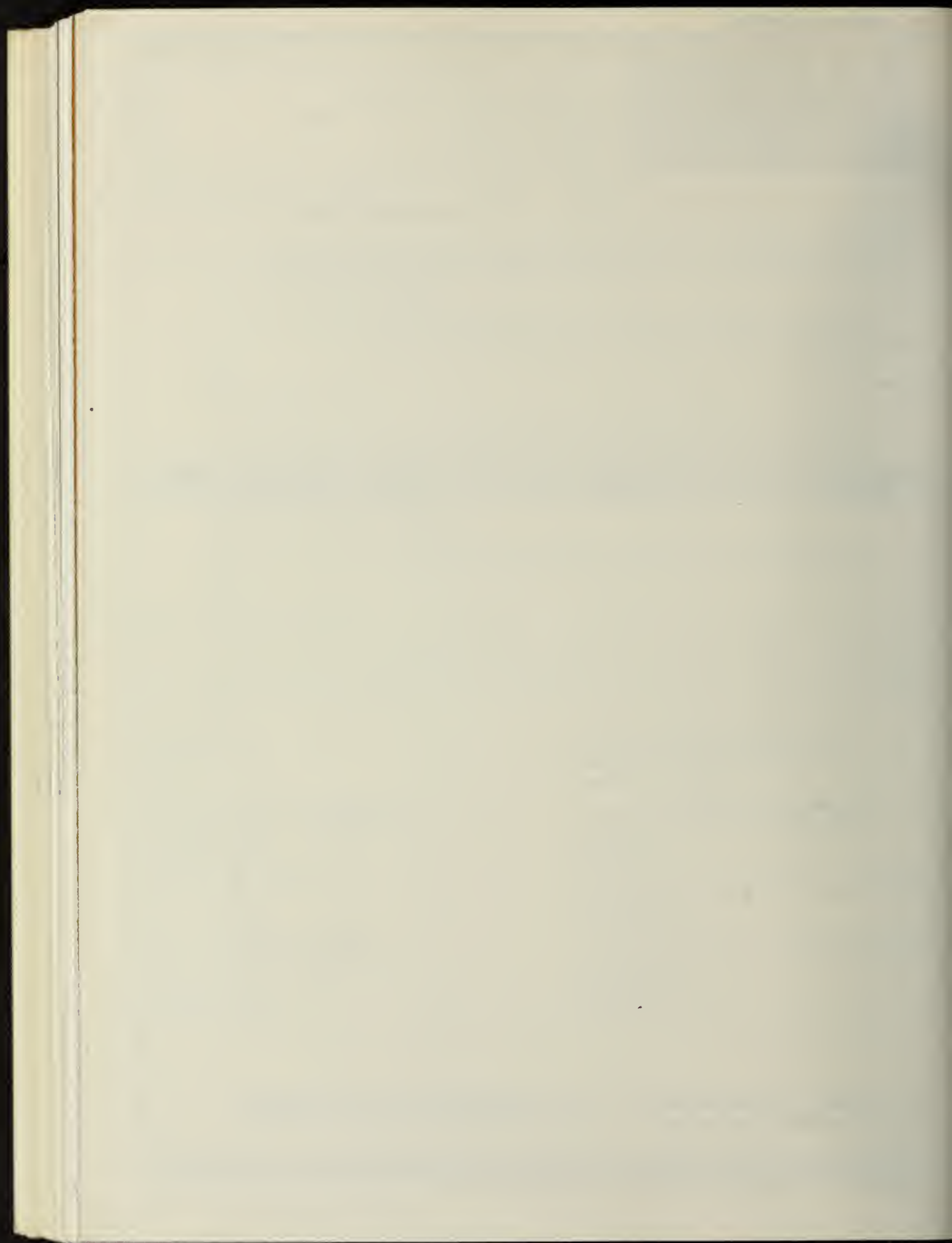
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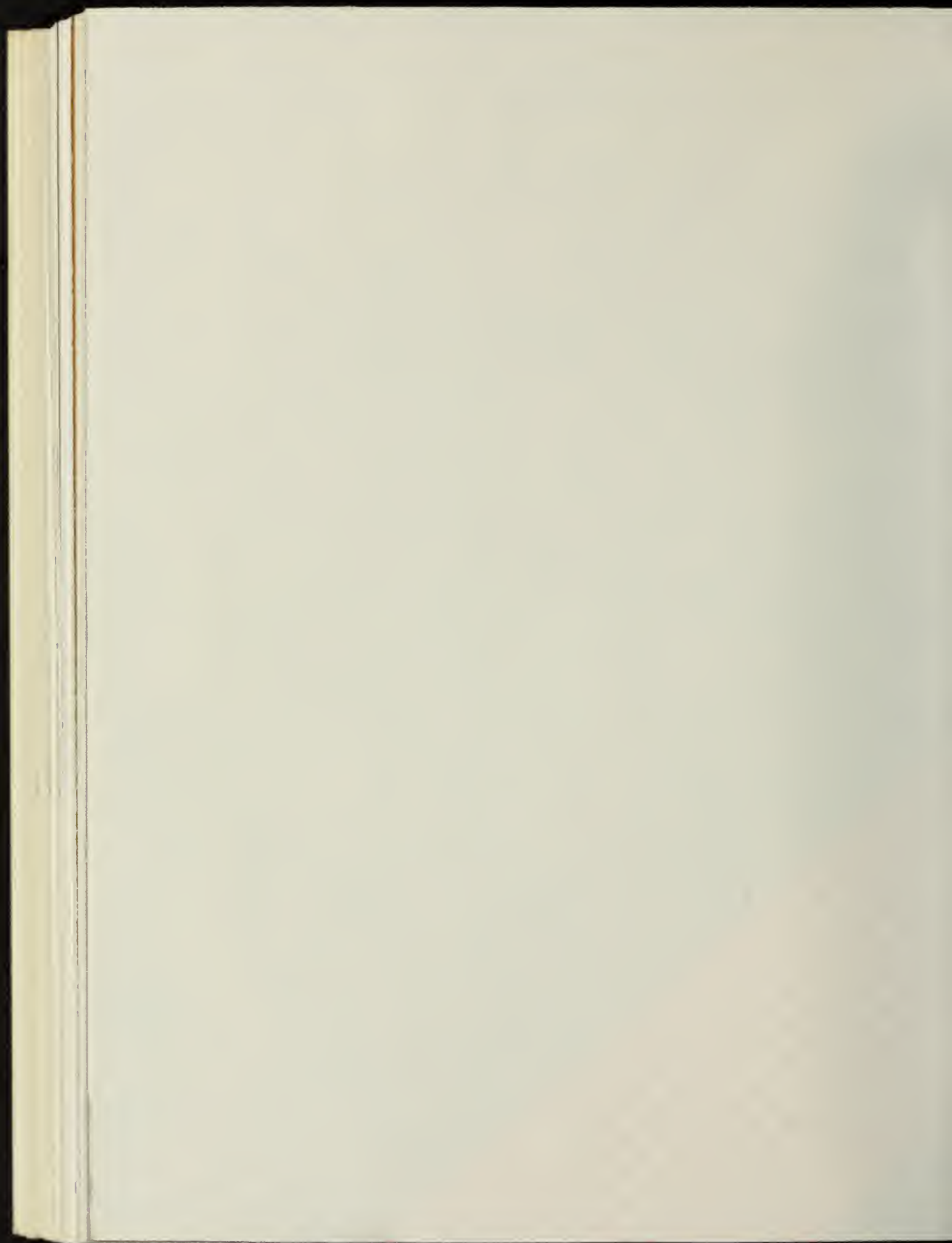
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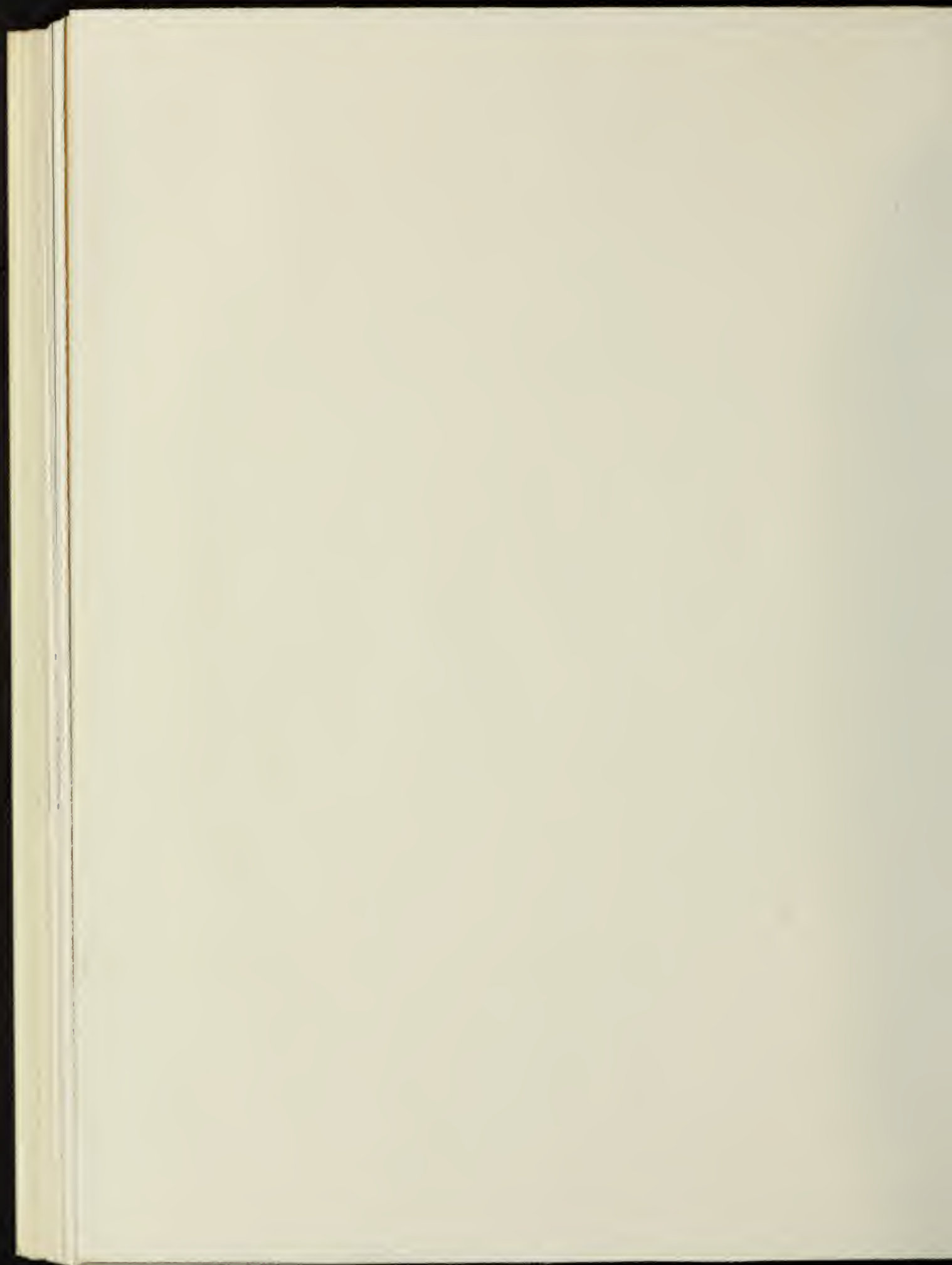
















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